Vol. XXXV. October, 1908 No. 4.

MUNICIPAL ENGINEERING

A MONTHLY MAGAZINE

DEVOTED TO THE IMPROVEMENT OF CITIES

CONCRETE CONSTRUCTION, PAVING, SEWERAGE, WATERWORKS, STREET LIGHTING, PARKS, GARBAGE DISPOSAL, BRIDGES.

PUBLISHED BY
MUNICIPAL ENGINEERING COMPANY
INDIANAPOLIS AND NEW YORK.

Registered in United States Patent Office

Two Dollars Per Year. Single Copies, 25 Cents.

THE BLOME COMPANY

Granitoid Concrete Blocked Pavement

PRINCIPAL BUSINESS STREET, CALUMET, MICHIGAN

This is the age of concrete; therefore, why not a concrete street pavement? Especially when unquestionable perfection has been reached in this direction by a concern of vast experience in concrete work of every conceivable nature.

The Blome Company Granitoid Concrete Blocked Pavement

not only possesses many advantages over the so-called permanent pavements now in use, but in addition thereto, eliminates practically all of the objectionable features. Our pavement has been adopted by many large municipalities and corporations throughout the United States as a result of most thorough investigations.

This pavement is fully guaranteed, is of monolithic construction, and is intended for traffic from the lightest to the very heaviest, and we are amply prepared to convincingly demonstrate that the pavements laid by us during the past ten years, many of which have been subjected to incessant trucking of the heaviest kind, today show less wear than any other form of pavement put to a similar test.

This pavement will successfully withstand continual usage in the warmest and coldest climates with the additional advantage that while concrete hardens with age, every other pavement deteriorates under the action of the elements.

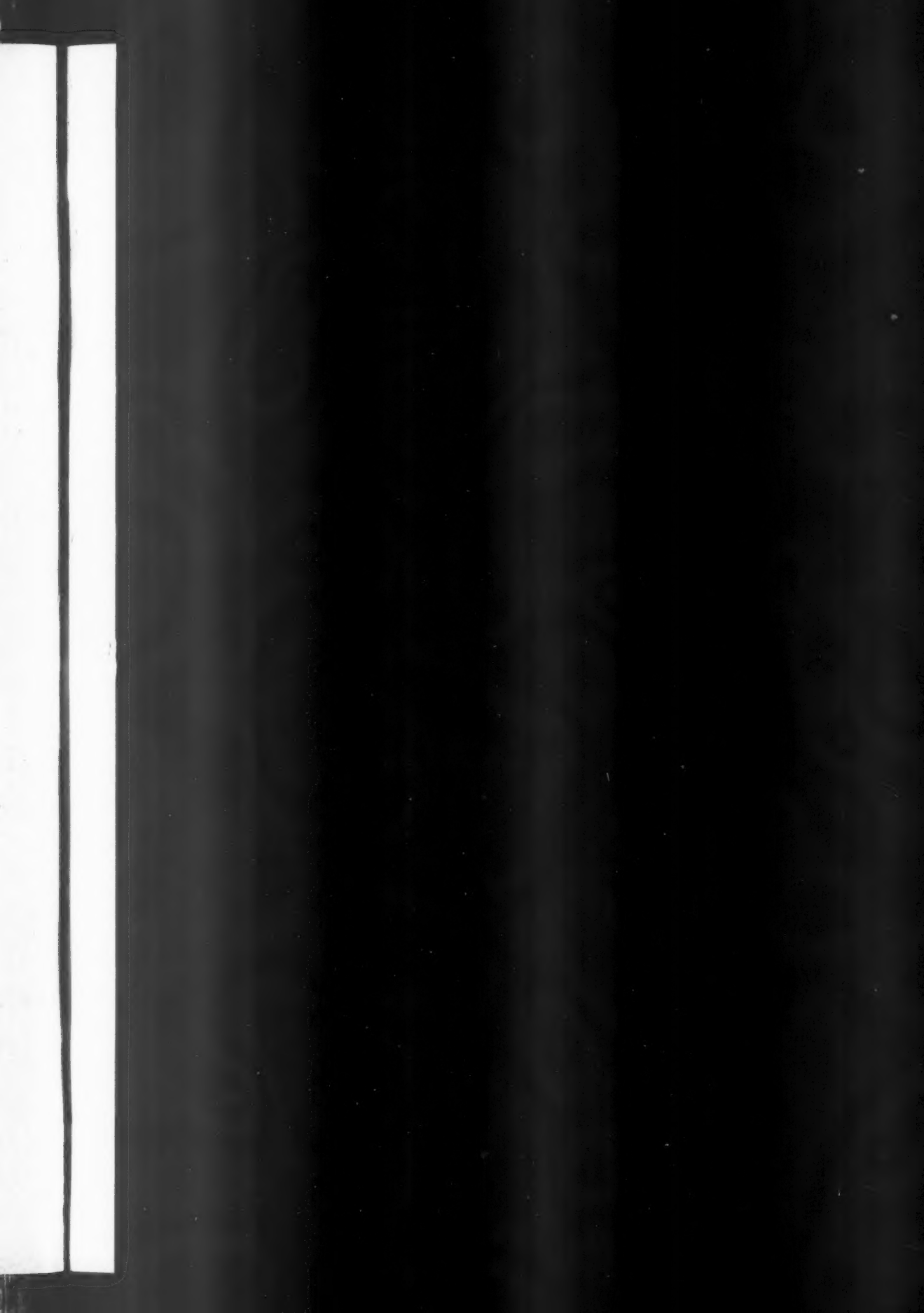
Our pavement is the most sanitary one on the market today and the most suitable one along and between street car tracks, as it can be neatly worked against the rails so as to leave no opportunity for the flanges of the wheels crumbling or disintegrating the edges of the pavement, and the cost of our pavement is not prohibitive.

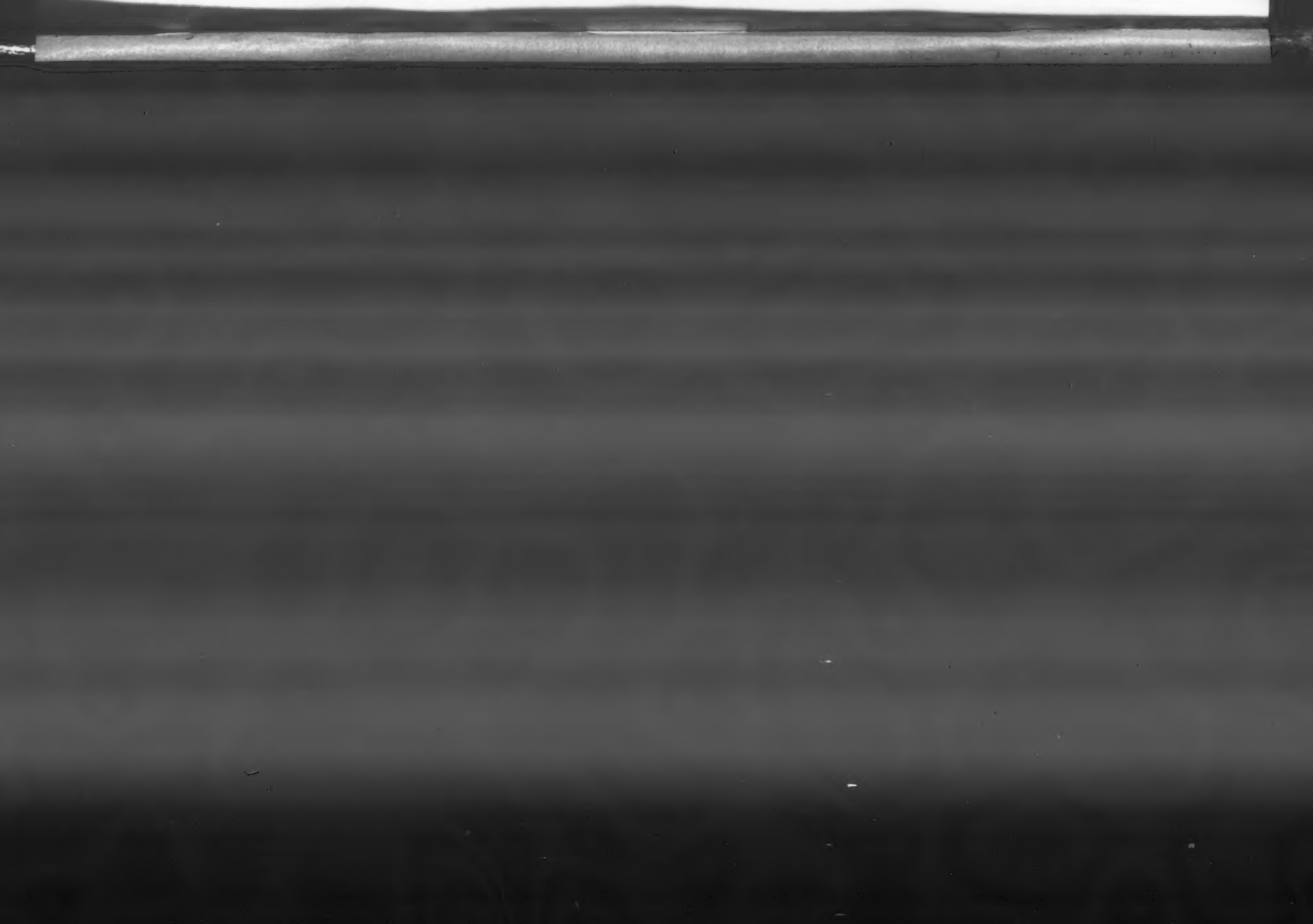
Our pavement has been laid on a number of streets in Chicago, Ill., Gary, Ind., Kalamazoo, Mich., Hancock, Mich., Calumet, Mich., E. St. Louis, Ill., Atlanta, Ga., Washington, D. C., Kewanee, Ill., etc., and we have also been awarded contracts at Ft. Worth, Texas, Palestine, Texas, New Orleans, La., Vicksburg, Miss., Knoxville, Tenn., Norristown, Penn., New Brunswick, N. J., etc.

We have representatives in all parts of the United States, and there is no city too distant to receive our prompt attention. To those interested we will be glad to furnish further details, as well as a list of city engineers and other city officials, various chiefs of construction of large railroad and industrial interests, any of whom will be glad to testify as to the merits of our pavement.

RUDOLPH S. BLOME COMPANY

BANK FLOOR, UNITY BLDG. Established 1866 CHICAGO, ILL.





Municipal Engineering

PUBLISHED BY

MUNICIPAL ENGINEERING CO., Indianapolis

NEW YORK OFFICE, 1 BROADWAY

Entered at Post Office, Indianapolis, Ind., as Second-Class Matter.

Vol. XXXV OCTOBER, 1908 No. 4

Contents

Sewage Disposal in Columbus, Ohio 211-216

Painting Cement Surfaces ..... *By P. W. Nelson* 216-217

The Philadelphia Subway and Elevated Railroad .... *By J. A. Stewart, Philadelphia, Pa.* 217-220

Condition of Indiana Water Supplies.
By Dr. H. A. Barnard, Chemist, in Charge of State Board of Health Laboratory, Indianapolis, Indiana 221-223

The Oiled Roads of Santa Monica, Cal. ..... *By C. B. Irvine, Santa Monica, Cal.* 223-224

A Municipal Abattoir in South Africa.
By R. A. Webster, Town Engineer, Krugersdorp, S. A. 224-225

The State's Need of a Commission to Study Municipal Problems.
By C. J. Crawford, Cape Girardeau, Mo. 225-227

The Bridges of Grand Rapids, Mich. 227-228

The Transmission of Typhoid Fever.
By H. E. Jordan, Chemist of Indianapolis Water Co., Indianapolis, Ind. 228-233

The Arc Lighting System of Portland, Oregon ..... *By B. C. Coldwell* 234-236

The Effect of Automobiles on Macadam Roads.
By Logan Waller Page, Director U. S. Office of Public Roads, Washington, D. C. 236-239

Editorial Comment.
Methods of Sewage Purification—Effect of Tar Macadam on Trees—State Control of Sewage Disposal—When is a Compliment? 240-243

The Question Department.
Specifications for Board Sidewalks—Information About Cement Sidewalks and Municipal Improvements—How to Build Residential Sewage Disposal Plant—Sewers Without Water Supply—Books on Sewage Disposal—System of Accounts for Small City—Use of Tar and Oil on Macadam Roads—Making Concrete Blocks Waterproof—Who Makes Plasterer's Corner Beads—Thickness of Concrete Block Chimney—Makers of Microscopes and Accessories—Ownership of Stream Bed—Effect of Standpipe on Water Pressures 244-248

From Workers in the Field.
Causes of Waste in Water Services and Mains—Methods of Using Copper Sulphate in Reservoir—Flood Water Channel and Reservoir Inlet—Cost of Operating Sand Filters—Cost of Repairing Asphalt Pavements—Distribution of Sizes of Water Pipe and Cost in Providence, R. I.—Concrete Street Paving—Pottery Clay at Hot Springs, Ark.—Waterproofing Concrete Pipe 249-256

Roads and Water.
Bitulithic Pavement in Portland, Ore.—State and State-Aid Roads in Washington—Extra Cost of Water System to Furnish Fire Protection—Valuation of Water Powers 256-257

Municipal and Technical Literature.
Municipal Reports 258-260

Organizations and Individuals.
American Society of Municipal Improvement—The League of American Municipalities—Technical Meetings—Civil Service Examinations—Personal Notes 260-262

Machinery and Trade.
Lectures on Electrical Engineering—Corrugated Iron Culverts—The Card Index for Price Lists—A Family in the Pipe Trade—Hendricks's Commercial Register—The Uses of Asphalt—In a Sewer for Sixty Years—Asphalt Business is Improving—The Municipal Asphalt Plant of Indianapolis, Ind.—Trade Publications—Trade Notes—Patents on Concrete Posts and Poles—Patents on Concrete Burial Vaults and Tombstones—Patents on the Manufacture of Cement 262-267

Improvement and Contracting News.

Paving	268	Garbage Disposal, Street Cleaning and Sprinkling	278
Sewers	272	Parks	278
Water Works	274	Fire Apparatus	278
Bridges	277	Too Late for Classification	278
Street Lighting	278		

$2.00 A YEAR. FOREIGN SUBSCRIPTION, $2.75 A YEAR. CANADA, $2.50 A YEAR.

Endorsed by All Leading Engineers

WRITE FOR ILLUSTRATED CATALOGUE

Reinforced Concrete Pipe

For Sewers, Conduits, Railroad Culverts and Water Pipe it has no equal.

MANUFACTURED ONLY BY

Reinforced Concrete Pipe Co. *Jackson, Mich.*

For All Territory West of the Rocky Mountains, Address the
REINFORCED CONCRETE PIPE CO., 625 Citizens' National Bank Bldg., LOS ANGELES, CAL.

MUNICIPAL ENGINEERING

VOLUME XXXV. OCTOBER, NINETEEN HUNDRED EIGHT. NUMBER FOUR.

SEWAGE DISPOSAL IN COLUMBUS, O.

COLUMBUS, the capital of the State of Ohio, is a city of over 150,000 population, which is built in the form of a cross, with the Scioto and Olentangy rivers as the directing line of the north and south branches and the old National road and the railroads fixing much of the east and west branches.

The sewer system grew up with outlets into the rivers and added an intercepting sewer for sewage, with overflows for storm water into the rivers, when the nuisances and pollution of the water supply became too great. In 1900 the city had a population of 125,560 and about 150 miles of sewers, reaching 80 per cent. of the population.

The mean discharge of the Scioto river above its junction with the Olentangy for 1899 was 755 cubic feet a second, with variations from 5 to 16,110; and that of the Olentangy was 438 cubic feet a second, with extremes of 8 and 10,180 cubic feet. It is estimated that the ordinary low water flow of the Scioto below the junction of the two rivers and below the city is 30 to 50 cubic feet a second.

With such minimum discharges as these in the two rivers which receive the sewage of the city, and in the combined streams below their junction, it is evident that the limit of discharge of unpurified sewage was soon reached.

The first report on an improvement of conditions was made by J. W. Alvord, who recommended double coke filtration, and suggested other methods involving chemical treatment or septic tanks followed by some sort of filtration. This was followed in 1900 by a report by Julian Griggs, city engineer then as well as when Mr. Alvord's report was made. He recommended a septic tank system, with an expected purification of 50 per cent. Mr. Griggs's report also recommended the construction of about 29 miles of storm drains, combined sewers and sanitary sewers, and some 90 miles have been built, are under construction or are projected for early construction. At the request of the State Board of Health, the city employed Rudolph Hering to inspect the plans, having expressed their opinion that the septic tanks themselves might at some time produce nuisance, and would not prevent pollution of the river at low water. Mr. Hering made a report in 1901, recommending detritus and septic tank treatment, followed by filtration. Plans based on this report were approved by the State Board of Health and the proposition to bond the city for $2,250,000 for the cost of the construction was defeated at an election held the same year.

In November, 1903, the question of expending $1,200,000 for a sewage disposal plant and making some improvements to the sewer system was submitted at a general election and carried. Hering and Fuller were appointed consulting engineers and John H. Gregory was made principal assistant engineer in charge of the detailed designs and the subsequent construction.

Much of the work being experimental, as stated in Mr. Hering's report, it was decided to build a small testing station provided with grit chambers, settling tanks, chemical precipitation tanks, septic tanks and filter beds filled with various materials and supplied with various kinds of apparatus for distributing sewage over the filters and regulating the rate of flow through them. George A. Johnson, the engineer in charge of the testing station, made a detailed and comprehensive report of the experiments made during a period of about a year in 1904 and 1905, in which he stated

the conclusions that the process of purification should include preliminary clarification of the sewage in basins holding about eight hours' flow, operated as septic tanks, filtering through sprinkling filters at a rate of 2,000,000 gallons an acre a day, and final settling in basins holding about two hours' flow, and plans were prepared upon this basis, with an ultimate capacity of the works of 20,000,000 gallons of sewage a day. These plans were approved by the State Board of Health in October, 1905, after a change had been made in the method of discharging sludge from the septic tanks into the river.

As soon as detailed plans could be prepared, contracts were let for materials and construction and the main parts of the structures have been completed. There is much of what may be called the plumbing work, in putting in gates, controllers, valves, etc., which is still in progress and will require considerable time, and the works are more readily inspected at this time than will be possible when they are in operation.

The preliminary constructions included a levee along the river for about two miles, carrying a railway track, thus protecting the works from high water and rendering supply of materials and coal to the plant easy; a pumping station with three 11,000,000-gallon and two 4,000,000-gallon centrifugal pumps to lift the city's sewage about 20 feet; a 48-inch cast-iron force main 1¼ miles long, to deliver this sewage from the pumps to the purification works; and a 10-inch water main to supply the works with water under pressure for many purposes. These constructions cost $460,000. The 422 acres of ground purchased as sites for the works cost $96,543.

In the 48-inch force main is a Venturi meter, with recorders and indicators in the sewage pumping station and the gate house at the purification works, so that the operators at both ends can know what is the pumpage and the flow through the tanks can be controlled so as to make the discharge on the filter beds uniform within the limits of the design. This control is exercised through two controllers in the gatehouse, where the effluent from the septic tanks enters the distributers to the filters. These controllers are two cone-shaped disks, whose position with reference to cylindrical shafts in which they rise and fall can be changed so that the flow from the septic tank effluent conduit into the distributing chambers of the filter beds can be varied in rate between the limits of 10,000,000 and 22,500,000 gallons in 24 hours. There is an overflow leading from the septic tanks directly to the river, for use in case the flow through the force main should exceed the maximum discharge permitted upon the filter beds at any given time long enough to test the full capacity of the septic tanks.

With these statements of the problem to be solved and of the preliminary steps required, a description of the works as constructed will give some indication of the probable success, in whole or in part, of the works as designed.

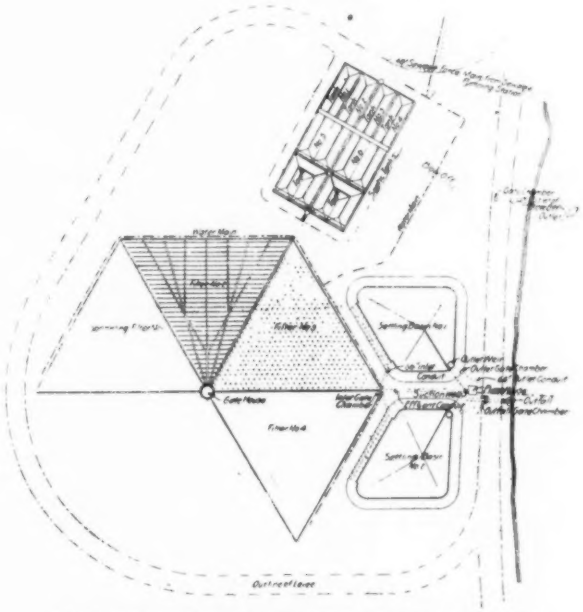
The septic tanks are at the upper end of the forty acres occupied by the plant, and are built largely above the original surface of the ground, so that the effluent from them in its partially purified state can be discharged directly into the river at the highest stage ever known, 19 feet above low water. The collection of tanks is rectangular in plan, 412 by 236 feet, inside measurement, and is inclosed by reinforced concrete walls and earth embankments.

The filter beds are on a lower level, such that the head on the nozzles distributing sewage over the filters can be as much as 8 feet, although the usual working maximum is expected to be about 5 feet. A regular hexagon containing 15 acres is divided into six equilateral triangles, each having an area of 2.5 acres and forming an independent filter bed. Four of these have been constructed, each having a filtering capacity of 5,000,000 gallons in 24 hours. These filter beds can operate until the water in the river has risen 7 feet above low water, when the back water will reach the floors of the beds, when the flow in the river is sufficient to permit the discharge of the partly purified effluent from the septic tanks directly into the river.

When operating normally the effluent from the filter beds flows into two settling basins, each of 2,000,000 gallons capacity, lying between the filter beds and the levee along the river bank. These basins can operate until the river has risen 5 feet above low water.

Some of the passages and apparatus for controlling the flow of the sewage and turning it into the courses desired are somewhat complicated, but perhaps a good general idea can be derived from the following description of the passage of the sewage through the plant:

The 48-inch main from the sewage pumping station discharges into a conduit built in the north wall of the septic tanks, from which it flows into any one or more of the primary septic tanks through 24-inch pipes, of which there are four in each of the four tanks. These tanks are each 59 by 150 feet inside measurement, with concrete walls. The end walls have expansion joints for each tank and each longitudinal wall has three expansion joints. The walls are 9 feet thick at the bottom, 2.5 feet at top and about 12.25 feet high. When the tanks are operating at the regular rate of 20,000,000 gallons in 24 hours, the depth



PLAN OF COLUMBUS SEWAGE DISPOSAL PLANT.

of sewage in the tanks will vary between 8.9 and 12 feet, according to the fluctuations in the rate of flow during the day, and the average period of flow through the tanks, with all in use, will be about 8.5 hours. At the opening of the works about half the tanks will be required, except in flood water periods, to maintain the same rate of flow.

The south wall of the primary tanks, which is 11 feet thick, is called the collecting and distributing wall, and serves to carry the sewage from any one or more of the four primary tanks on its north side to either or both of the two secondary septic tanks on its south side. This is done by means of three conduits running lengthwise of the wall in its middle portion.

The lowest of these three conduits is egg-shaped in section and takes the sludge from all the tanks out and discharges it into the river. Each of the primary tanks has a sludge channel in its bottom, which discharges into this sludge conduit through a 24-inch pipe. The secondary septic tanks are divided into north and south parts by a low wall. Each half of each of the north parts has a similar sludge channel discharging into the sludge conduit, and the south parts have sludge channels discharging into a sludge sewer in the wall between the two secondary tanks and thence into the sludge conduit. The primary tanks may have considerable sludge and debris to remove, the north parts of the secondary tanks will have much less and the south parts very little, with correspondingly long periods between cleanings. Overflows from above drop down through the wall into tne sludge conduit, so that it aids in the disposal of sewage in excess of the capacity of the plant by discharging it directly into the river after it has passed through the primary septic tanks. The sludge conduit discharges into the 48-inch blow-off pipe, which

has an outlet directly into the river, for use when used as an overflow or when the river is at very high stages, and also has a discharge through a 16-inch pipe laid in the bed of the river, with three outlets, 8, 10 and 12 inches in diameter, each with a flap valve, for use when the sludge is being cleaned out of the tanks. These outlets were required by the State Board of Health, so that the danger of nuisance from the discharge of the sludge would be reduced to a minimum. It is expected that the amount of sludge collected in the tanks will be small enough so that the times of cleaning can be selected at stages of the river high enough to carry the sludge with sufficient dilution.

The middle conduit in the collecting and distributing wall is circular in section and is slightly below the normal low water level of sewage in the septic tanks when in regular operation. It has sixteen 24-in. pipe connections with the primary septic tanks and the same number with the secondary tanks. With all the tanks in operation the flow of sewage would tend to be straight through these pipes from the primary to the secondary tanks. But in case any one or more of either set of tanks were to be thrown out of action, closing of the proper gates woud shut it out of connection with the other tanks. By opening and closing the proper gates sewage can be turned from any tank to any other, either primary or secondary. Connections with the sludge conduit can be opened in case excess of sewage flow threatens to overflow the top of the tanks.

The upper conduit in the collecting and distributing wall is rectangular in cross-section. This serves as an overflow to relieve excess flow of sewage and discharges into the river directly through the blow-off or through the sludge conduit.

The two secondary tanks on the south of the collecting and distributing wall, into which the sewage flows from the primary tanks, are each 118 by 262 feet, the east and west outside walls being continuations of the outside walls of the primary tanks. These secondary tanks are divided into two parts, the north and the south, by a baffle wall 8 feet high. A scum-board is attached to this wall by arms which can rotate, so that the board floats on the surface of the water and projects 8 inches above it, preventing the passage over the baffle wall of the scum which forms on the surface of the sewage in a septic tank. The north part of the secondary tanks is 135 feet long and the south part is 127 feet long. In front of the south wall of the secondary tanks is another baffle wall, with its scum-board, over which the septic tank effluent flows into a chamber connecting by means of 24-inch pipes, controlled by gates, with a circular 66-inch conduit built in the wall. This conduit collects the sewage which has been partially purified by the septic tanks and carries it to the gatehouse in the center of the filtering area. The conduit is built into the wall which separates filters Nos. 2 and 3.

The flow of sewage through all parts of the plant is controlled in the gatehouse in the filter bed, and the collection of gates, controllers, passages, etc., is quite complicated. The principle, however, is quite simple, and can be described readily without reference to the exact location and distribution of the various pieces of apparatus making it effective.

The sewage, entering the central well in the gatehouse under the head due to the elevation of the surface of the water in the septic tanks, rises through two smaller wells inclosed within the larger one. In these two smaller wells are two controllers which fix definitely the rate at which sewage flows to the filters, as stated in the general description of the plant above. Ordinarily this rate is maintained at the most advantageous rate for the filters, and the fluctuations in tne rate of receipt of sewage through the 48-inch force main are taken care of by the automatic change in level of sewage in the septic tanks. It is possible for the supply to be enough greater than the storage capacity of the tanks for an occasional overflow of sewage for a few minutes. The filter beds are expected to be able to take care of a small excess for a short time, and so an overflow is put in the receiving well in the gatehouse, which is a little lower than the overflow from the septic tanks directly into the river. Tnis overflow discharges into the sewage distributing system in the beds and thus increases the supply to them. Should the inflow of sewage become greater than the capacity of this overflow, the overflow directly to the river, located in the collecting and distributing wall in the septic tanks, above described, comes into action.

From the controllers the sewage flows through a ring-form distributing well to distributing chambers, one for each half of each bed, thence through

the beds, as described below, and back to a sump for each bed.

The four triangular filter beds, which have been constructed, each with one apex at the gatehouse, are 505 feet on each side and each covers 2.5 acres. They are filled with broken stone, 10 inches in depth at the bottom being of 3 to 4-inch stone and the upper 4 to 5 feet being of 1.25 to 3-inch stone. The surface of the filters is level and the difference in thickness of stone is due to the slope of the bottom. Each filter bed is divided into halves for purposes of distribution and collection of influent and effluent, and the following description is of half of one bed and will apply to all: There is no division between the halves. From the distributing chamber, above mentioned, the sewage flows in a 30-inch circular reinforced concrete conduit laid down the center line of the bed, with a rising grade of 14 inches to the outer wall; thence through level 5 and 6-inch vitrified pipes laid parallel to the outer wall and about 13 feet apart, and thence through 3-inch cast-iron risers leaded into the T's of the vitrified pipe and set 15 feet 4 inches apart. On top of these risers are the sprinkler nozzles for distributing the sewage over the surface of the bed. A nozzle is composed of an orifice with rounded edges, 9/16 inch in diameter, and an inverted cone held above it by two thin arms. The angle of the cone is 90 degrees, and the sewage, rising through the orifice under a head of 2.75 to 8 feet, is deflected by the cone and falls in a circular spray over a circle with a maximum diameter, according to the design, shown by the distance apart of the nozzles on the risers, given above. By varying the head on the nozzles, by the change in level of the water surface in the septic tanks and manipulation of the regulators, the diameter of the circle can be changed at will and the distribution of sewage over the surface can be equalized to a certain extent. Recent experiments showed that under the conditions of the experiments the distribution varied with constant head of 5 feet, from 5 per cent. of the average on the outside of the circle to three times the average on a circle of one-half the radius of the outside circle; and that with varying heads the distribution varied from 5 per cent. of the average on the outside circle to six times the average near the nozzle.

The broken stone in the filters rests on a pavement of 6-inch vitrified half-pipe, made with two notches on each edge and laid with the convex side up. The edges of these pipes were firmly set in the concrete bottoms of the beds before that concrete had set. The filtered sewage finds its way through the stone and the notches in the sides of the pipes into the arch of the pipe, through which it flows on the sloping concrete bed to main collectors, which divide the half filter bed into sections, such that the water flows about 60 feet in these collecting pipes to the main collectors. These main collectors are concrete channels, 20 inches deep at outer end and 26 inches deep at sump, with circular bottoms and covered by reinforced concrete roofs, giving ample inlet for the water from the collecting drains, which discharge into them all along their sides. The main collectors from the two halves of a bed join in a twin collector, the two running parallel for the last 70 feet or so to the sump outside the gatehouse.

From these sumps the purified sewage flows to the effluent well in the gatehouse, and thence by a 66-inch circular effluent conduit in the wall between filters Nos. 3 and 4 to the gate chamber of the settling basins.

The settling basins are irregular in form to suit the space between the hexagonal filter bed area and the straight levee. Each of the two holds 2,000,000 gallons and is 4 to 4.5 feet deep. The inlets to the basins are a number of 21-inch vitrified pipes, distributing the flow to produce as little disturbance as possible. The outlet from each settling basin is a circular well with steel lip and scum-boards, discharging through a pipe into the river.

A pumping station, with a 4,000,000-gallon centrifugal pump and natural-gas engine, pumps the sludge from the settling basins into the river or upon land for treatment, as may be desired.

The practical results from this plant will be awaited with interest. The plans are the result of careful study of an experimental plant, but works on a large scale do not always follow the lead shown by the smaller plants.

J. H. Gregory is the engineer in charge of the plans and construction, under the general supervision of Hering and Fuller, consulting engineers, and E. A. Kemmler is the engineer of construction in direct charge of the sewage purification plant, to whom we are indebted for courtesies in securing the information upon which this article is based, as well as to Julian Griggs, formerly city engineer, under whose administration the preliminary

studies and plans were made. The work is done under the Board of Public Service of Columbus, and Henry Maetzel, the present city engineer, is in charge of the financial matters in connection with the contract.

PAINTING CEMENT SURFACES.*

By P. W. Nelson.

IT is only in comparatively recent years that cement has come into more extensive use as a building material, and it is but natural that the majority of us are as yet undecided about how to proceed in the painting over cement, because we have not had sufficient time in which to make our experiments, note the results and arrive at a positive conclusion. A great many experiments have, of course, been made, but most of them without a trace of scientific reasoning back of them. As an example, I will relate what an Eastern painting contractor told me recently in regard to painting on cement.

He said he always had more or less trouble with cement surfaces until he found a method which he could rely upon. His method was to give the surface a coat of strongly glued calcimine before applying the oil paint; this might have helped him out at the time, but it is certainly no method which can be safely recommended.

Many hastily conducted experiments have led to wrong conclusions, and it has even happened that two men, experimenting along the same lines, have come to opposing conclusions. The reason for this is that there is a difference in cement and cement surfaces, and our aim is to find, if possible, a method which will give satisfactory results in all cases.

It has long been the popular opinion that linseed oil is hurtful to cement, and also that no oil paint would endure if applied direct to the cement. I believe both of these opinions to be wrong.

One of the foremost authorities on cement assures me that he has been painting with oil paint over cement for many years with the best results.

It is true, however, that all non-drying oils are more or less destructive to the cement, and if the cement wall should be saturated with raw linseed oil there is no doubt about the outcome, as the oil would slowly disintegrate the cement. But for painting we do not use non-drying oil, and our oil paint will dry on the surface without affecting the cement, a fact which has been fully demonstrated. As for the cement affecting the oil paint, so is that more apparent than real. It is held by experts that cement surfaces properly executed, clean and dry, are no more dangerous to oil paint than the modern wall plasters.

Undoubtedly most of the trouble is caused by the painting being done before the cement is dry. Cement dries very slowly. The opinion of men who are experts in the use of cement say that a cement wall must stand at the very least over one summer before painting with oil paint can be commenced.

The first thing required is to wash the surface thoroughly with a weak solution of muriatic acid, followed with a good wash of clean water. The strength of the acid solution should be about 7 or 8 per cent. This wash will clean the surface, neutralize to a large extent the alkali, and thus make on the smooth cement surface enough of an impression to give the paint a proper hold. The surface must then be given time to dry perfectly.

In painting it is well to use considerably more turpentine than is ordinarily the case, and very little dryers. In fact, boiled linseed oil is considered preferable to raw. For priming, the paint should be used thin, and contain so much turpentine that it is almost flat, increasing the amount of oil for succeeding coats. Each coat must be given ample time to dry before the next one is applied.

For water color or calcimine, washing with muriatic acid solution, followed by clean water, should be done if first-class work is to be expected. When the surface is thoroughly dry it should be given a coat of alum size, or, still better, a coat of flat paint, and when the size is dry the surface is ready for calcimining.

One painting contractor, who does a

*A paper before the Ohio State Association of Master House Painters and Decorators.

great amount of work in our Eastern sky-scrapers, tells me that he makes a size of equal parts of acetic acid and alum. His formula is one pound of acid, one pound of alum and two gallons of water. I have not tried this size, so I give it for what it is worth.

If the treatment suggested should prove not to be all we expect, it is at least the best I have, through diligent search, been able to obtain, and one that I believe is the best so far put forward.

So far so good, but in this method there is one thing which nearly everybody is opposed to using in paint nowadays, namely, time. Time is the great sesame for all painting. Give the surface time to dry and let one coat dry thoroughly before another is applied, and we will have far better work than is usually the case.

In our modern rush the painter is, however, often forced, against his protest, to paint over a surface long before it is dry enough to receive the paint. This is true not only of cement, but also of plaster and sand finish. We all know there will be trouble when painting is done over a wet surface, and with cement the main difficulty is that it dries so very, very slowly that it is invariably painted before it is half dry. It may appear dry on the surface and still contain a large quantity of moisture.

To meet this demand for rush, inventive minds have set to work to make a paint which can be applied over cement as well as plaster surfaces while the same are still damp. There are a few such paints on the market to-day; some are manufactured in paste form to be thinned down with turpentine and benzine. They dry out perfectly flat, have great covering power and will adhere to the damp cement or plaster by virtue of the fact that they will permit the moisture in the wall to evaporate through.

It must be plainly understood that ordinary oil paint or enamel cannot be applied over them until the wall is thoroughly dry, because such coating will close up the pores of the wall, so to speak, prevent the moisture from escaping and force it to accumulate behind the paint, causing the paint to blister and come off.

THE PHILADELPHIA SUBWAY AND ELEVATED RAILROAD.

By J. A. Stewart, Philadelphia, Pa.

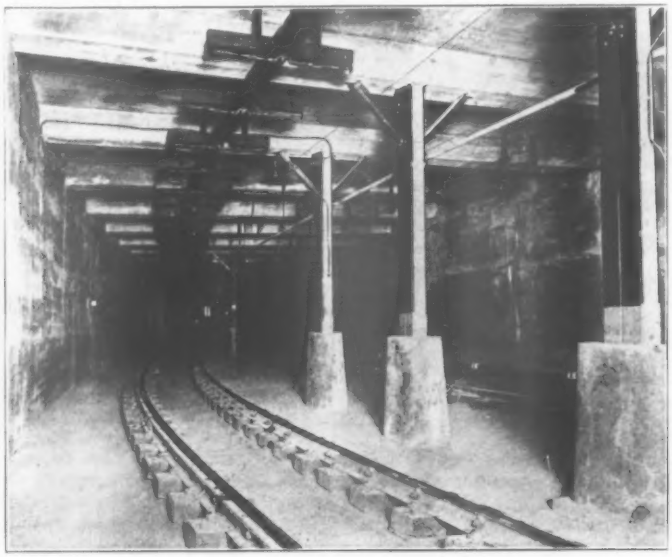
THE opening of the eastern division of the subway under Market street, Philadelphia, marks the completion of the new underground and elevated street railway system, which has been in course of construction for over five years. The elevated and subway, now completed and opened for public traffic in Philadelphia, extends from Sixty-ninth street to the City Hall and east to Second street, and south on Delaware avenue, and forms a splendid artery of travel through the great retail business section. The East Market street portion of the subway is the important link between the West Market street elevated road and the three-quarter-mile subway (from the Schuylkill river west to Sixty-ninth street and east to City Hall), opened in 1905, and the elevated system running south on the Delaware river front.

Many interesting features mark its construction, the chief characteristic being permanency and solidity. The East Market street subway presents a solid concrete surface, 67,600 cubic yards of concrete having been used in its construction. The roof and the side walls are of reinforced concrete. The roof is supported by a center row of steel columns between the two tracks, except where provision is made for crossovers between the east and west-bound tracks, where the columns are omitted and the roof is made in one span. The waterproofing of the roof is asphalt mastic, protected by concrete. The floor is of concrete, reinforced with steel rods below the ground water level. The bottom flanges of all steel girders and all steel columns between the track and station platforms are also protected by a covering of concrete. The only portion of the subway where steel is exposed is within the limits of each station, where the roof is composed of steel beams with concrete jack arches. On curves and at cross-overs pairs of columns are protected against collision

by derailed trains by concrete piers inclosing them.

Two noteworthy features of the Philadelphia subway are the new form of roadbed and the complete and extensive stations provided. Instead of the usual ballasted roadbed, with rails spiked to wooden crossties, Mr. W. S. Twining, chief engineer, and his assistants have constructed a novel track entirely of concrete. Square iron supports, intended to give the necessary elasticity, were placed under the rails before the concrete was poured over them, and then permitted to harden. This arrangement does away with the necessity of frequently removing ties and with the bad odors arising from grease dropping on the broken stone and the wooden sleepers. It is evident, too, that a maximum of thought and attention has been applied to the plans for the stations of the Philadelphia subway. No subway in the United States has stations like those at Eighth and Thirteenth streets, which are combined stations and vestibules to the great dry goods emporiums and department stores, whose brilliant store windows border the platforms, and all of which have constructed special and imposing entrances from their basements into the subway stations, at their own expense. These stations are 350 feet long and about 100 feet wide. As the East Market street subway itself is but 26 feet 6 inches wide inside, the effect of the expansion at the stations is most pleasing and impressive. They appear like a section of a street in the shopping district, brilliant with window displays. Cross-overs of concrete lead from one side of the stations to the other over the tracks. Ornamental railings of iron separate the bridge platforms from the train platforms below.

The most striking feature of the only circular section in the subway (where the underground curves around City Hall) is the manner in which two sets of tracks have been constructed to cross each other at different levels. The West Philadelphia surface-subway cars running on two special tracks in the West Market street subway have their terminal at City Hall, wnere they turn and go westward on a loop which entirely circles the public buildings. These loop tracks have been depressed by a rapid grade passing 18 feet below the through tracks.



PHILADELPHIA SUBWAY SHOWING DETAILS OF STRUCTURES.

The heavy traffic on Market street has gone on with as little interruption as possible during the tunnel construction. The work has been carried on with special reference to keeping the street free, and the operation of surface street cars over the two tracks in the center of the street has never been interrupted.

The single, old-fashioned circular sewer, 6 feet in diameter, was first re-

moved from the center of Market street, and in its place were constructed two reinforced concrete sewers on either side of the street, varying in size from 3 feet in diameter to 7 feet 7 inches. The total length of these sewers is 11,610 feet. The length of the East Market street subway is 7,130 feet, and, including the loop around City Hall, it contains 16,748 feet of single track. From the west portal, at the Schuylkill river, to the east portal, at Second street, there are 6¼ miles of single track. At its highest point the subway is 14 feet 5½ inches from the base of rail to underclearance, and at the lowest point its height is 14 feet 2 inches. Four hundred thousand cubic yards of earth were excavated from Market street, and the engineer's estimate places the amount of steel and iron used in the construction at 12,620,000 pounds; of concrete, 67,600 cubic yards.

PHILADELPHIA SUBWAY STATION SHOWING UNDERGROUND SHOP WINDOWS.

The new Philadelphia subway cars are of solid steel construction, with the interior furnishings in mahogany. The seats run the length of the car, are covered with knitted cane, and provide seating capacity for fifty-two persons. Each car is lighted by twenty-five sixteen-candle-power incandescent lamps, and provision has been made for heating in cold weather. The cars are equipped with two 125-horsepower motors. These motors are under the cars and connected together with cables. Each car has an electric headlight and two electric marker lights on either end to indicate its destination. The dimensions of the cars are 39 feet 6 inches inside (including platforms, 49 feet 5 inches), in length; 8 feet 7 inches total width. The cars are provided with center doors.

Much attention has been given to safety. The Philadelphia Rapid Transit Company is said to be the first street railway corporation to adopt the new automatic air couplers, which make the necessary connections at the instant the cars come in contact with each other, and without any intervention. The new controller handle, installed on the Philadelphia subway and elevated system, is so arranged that should the motorman for any reason remove his hand from the handle, it immediately returns to the point which stops the current and the cars. The automatic air valves in use on steam railways are used, also an electro-pneumatic block signal system and interlocking switches.

It is expected that ventilation will never become a serious problem. The stations in the east section take up 20 per cent. of the entire length, and a constant circulation of air is practically assured. In addition, ventilation chambers are built in the side walls at intervals. They are connected to the outside and are so arranged that fans may be installed in them if necessary.

As has been indicated, the completion of the eastern section is the important link in the completion of the entire east and west system. The Del-

aware avenue elevated completes the line from Market street to South street along the Delaware river front, a distance of 4,150 feet. The work on this was started two years ago, at the time when the East Market street subway was begun. The roadbed is from 28 to 34 feet above street grade, and the weight of the steel superstructure represented is over 6,000 tons; 115,000 feet of timber piles, 225,000 pounds of steel and iron, and 3,600 cubic yards of concrete have been used in the construction, which follows the same lines as that of the West Philadelphia elevated, west of the Schuylkill river. Noise has been reduced by

DELAWARE AVENUE ELEVATED RAILROAD, PHILADELPHIA, PA.

the concrete flooring, upon which the ballast and the rails are laid, deadening the sound and preventing drippings upon the traffic beneath. The third rail is placed at one side of the track and not between the rails, and it is raised about 18 inches above the tie and covered for its entire length on top and sides, with a wooden trough, which serves to insulate it. The ties are permitted to rest in loose ballast instead of being fastened to the superstructure, making the rails last longer and bringing less strain upon the bed, which means much cheaper maintenance and operation charges, though the initial cost is great.

The opening of the Market street subway and elevated marks the fiftieth year of street railway transportation in Philadelphia. The first horse car line to be built in the Quaker City was that on Fifth and Sixth streets, in 1858. Development in transportation facilities was slow and steady, being more rapid after the civil war. Cable lines were built on Market street and on Columbia avenue in 1883, followed by others in 1886 and 1888.

When electric cars were invented, conservative Philadelphians made a great protest against their introduction, defeating a project to electrify the Spruce and Pine street lines. A successful beginning of an electric system was made in 1892, on Catherine and Bainbridge streets, which was soon followed by the general electrification of all the lines in the city.

Work on the initial subway and elevated system was begun in 1903. Its construction is the introduction of a comprehensive scheme involving radial elevated lines and subways in many different directions, and it makes a notable addition to the list of important current municipal engineering operations and to the great structural street railway enterprises of the United States.

CONDITION OF INDIANA WATER SUPPLIES.*

By Dr. H. A. Barnard, Chemist, in Charge of State Board of Health Laboratory, Indianapolis, Ind.

THE water supplies of our State can be variously classified, but for our present purpose it is most convenient to discuss them under the heads of spring, well and surface waters. In the class of spring waters we include those supplies which flow continuously or intermittently from the ground, or from fissured rock; well waters are those which are reached by an excavation either by digging or boring a cylindrical hole into the subsoil or stratum underlying the surface of the ground, the interstices of which are filled with water; surface waters include rivers, ponds and lakes, either natural water courses which carry away the accumulated rainfall or basins which store the water that drains from the surrounding watershed.

Spring waters are derived from the rain which, falling upon the ground in a relatively pure condition, passes readily into the pervious soil, until it reaches an impervious stratum along which it may flow for miles, losing by oxidation and filtration whatever organic matter it may have accumulated before it passed into the soil, and finally emerging at some rock fissure or gravel bed, clear and sweet, and as nearly pure water as nature furnishes. The character of the water depends upon the nature of the materials with which it comes in contact in its underground flow. If, for example, it passes through beds of gypsum, it will contain much sulphate of lime; if over beds of iron ore, it will be chalybeate in nature.

The surface waters of the State which before development of industry were without doubt potable, are at the present time for the most part loaded with waste products of manufacturers and the offal of nearly 3,000,000 people. Our great rivers, the Wabash, Ohio, St. Joe and White, are trunk sewers utilized by every community on their watershed for carrying to the sea the waste products of our civilization. It has long been thought that running water would purify itself; that any sewage flowing into a river would be destroyed by oxidation in the course of twenty miles' flow, and chemical analyses have tended to support this assertion, but most of the apparent purification of running streams results from the great dilution of the sewage by the constant increase in the volume of a river, from both tributary streams and inflowing ground water. In this way the poisonous matters may be so diluted that they are beyond the power of chemical analysis to detect.

Deep well waters, that is, waters that come from strata lying in or below an impervious layer of stone or clay, in this State the limestone formations, are not liable to be contaminated by sewage and are more easily obtained and distributed than surface waters, which have to be brought miles from their source or purified at great expense. Deep well waters are not desirable as public supplies for several reasons. In the first place the supply is always limited. If the watershed is large or if the wells are sunk in a valley which conveys underground waters flowing off an extensive watershed, the supply may be ample. But if the watershed is not large, the supply of water underlying it will be limited and no number of wells can obtain the necessary amount of water. Deep well waters are usually hard and frequently contain much iron, and are not desirable for domestic, laundry or steam purposes. The deep well supplies now in use in Indiana are for the most part furnishing a safe water at the present time, and some of the systems are supplied with an abundance of water.

While our larger cities and towns rely on either the filtered surface water or ground water supply, at least 2,000,000 citizens of the State, inhabitants of the smaller towns and country districts, are dependent for their water supply for drinking and domestic purposes upon private wells, extending down into the subsoil or stratum underlying the surface, which is filled with water held by an impervious layer below in the interstices of the rocks lying immediately beneath the soil and constituting about 40 per cent. of the soil which it occupies. The surface of this ground water is not level, but slopes towards its natural drainage outlet, from two to eight

*From a paper before the Indiana Sanitary and Water Supply Association.

feet to the mile. The water thus forms a subterranean river, always flowing in one direction. A well penetrating the stratum through which this river flows is filled by the water to the same height that it occupies in the soil. If the water in the well is wholly undisturbed there will be a constant but imperceptible current in it in the direction of the flow of the ground water, and there will be no flow into the well save in one direction. But if the well is freely drawn upon, so that the level of the water is below that of the water in the surrounding earth, inflow will take place from all directions. This inflow is liable to take place from a distance in the direction from which the ground water flows. Hence we may accept it as a fact that filth within one hundred feet of a well will influence the character of the water. But this is not the whole truth, for the original source of filth may be much further away and have gradually defiled the soil in the direction of the well until it extends within its influence. Cesspool filth has been known to permeate through the soil for a distance of two hundred yards and poison wells.

In a small rural village the supply of water from wells may have been of unexceptionable quality for an indefinite time, but the place grows, population becomes more dense, the ground water is drawn upon in excess of the supply, the drainage area of the well is increased, and the water becomes less pure, both from this cause and from the increased amount of sewage returned to the soil, which is sure to become saturated beyond its power of oxidation. Wells should be abandoned as a source of water supply for household use whenever there are more than two houses to an acre of land.

The condition of the private well is best illustrated by the following figures, which show a summary of our work of the last two and one-half years, as well as what will have to be done before the character of the water used by the country householder is as good as that supplied the citizens of towns where the public supply is used.

We find that 1,252 private well waters have been analyzed, of which 595 were pure, 509 bad and 148 of doubtful quality. If we class the doubtful waters as bad, since they will eventually reach this condition, we see that 657 or 52 per cent. of the private well supplies are of such quality as to be unsuitable for drinking and domestic use. If this figure holds good throughout the State we can readily see why the typhoid returns from the country districts are always high. Making another classification based on the source of the waters, we find that of 392 deep well waters analyzed, but 70 were bad, 39 doubtful and 283 were of good quality. The deep well is evidently a satisfactory private supply if it is derived from true second water. Of 797 shallow wells 417 were undoubtedly bad, 276 were good and 104 were of doubtful quality. It is not surprising that many wells are polluted, because the universal custom of grouping the house, barn and water supply within easy reach of each other has made the well the center of drainage area for all household sewage and farmyard waste. Great numbers of these old wells are still in common use, and, save where analysis has proven the water to be filtered sewage, of good repute in the community. The importance of an analysis of these well waters cannot be overestimated. In some towns where public sentiment has been aroused, a series of analyses has shown that hardly a single well in the thickly settled village was suitable for use, because of the presence of sewage effluents. Where such condition exist, and our results convince us that they are by no means uncommon, a water supply brought from some uncontaminated source becomes a public necessity.

In comparison with these figures we will turn to the water from the public water supplies. In all, the water from 394 public supplies has been analyzed, and of the number 257 supplies were of good quality, 52 were bad and 85 were of such character that they were classed as doubtful. Most of the bad waters were taken from shallow or driven wells located in the public square or by the side of the street where they were exposed to all sorts of pollution. In order to better illustrate this point we have made another classification based on the source of the sample. Of the 200 deep or subsurface waters used as public supplies, 148 were entirely free from pollution, 11 were classed as bad and 41 were of doubtful quality. Several of the bad and most of the doubtful waters were so classed because of the high content of ammonia, chlorine and iron present, and not because there was any evidence of pollution by sewage. Certain waters, especially from the coal and gas belt, have a high chlorine and ammonia content, which renders them undesirable for drinking or domestic use, although there is no claim that such waters are capable of pro-

ducing disease. Of the shallow or surface wells but 20 could be passed as pure, while 21 were undoubtedly bad and 13 were evidently in a transition stage from good to bad. If we class these last wells as bad, a condition they will doubtless reach eventually, we find that but 20 out of the 54 shallow wells used as public supplies were above suspicion. But 55 of the 84 stream supplies were pure; 9 were undoubtedly bad and 20 were receiving sewage either directly or as the runoff from cultivated and inhabited ground. None of the 27 pond supplies were bad, although 8 were of doubtful quality. Of the 29 springs, 15 were good, 11 bad, and 3 of doubtful quality. It is not probable that these bad springs were true spring supplies. They were evidently waters draining off inhabited areas and breaking out at some fault a short distance below the surface, rather than deep ground waters.

THE OILED ROADS OF SANTA MONICA, CAL.

By C. B. Irvine, Santa Monica, Cal.

SANTA MONICA, CALIFORNIA, with more than thirty miles of oil-paved streets, is being looked up to by Southern California cities that seek the permanent improvement of their highways, and the news is spreading to municipalities throughout the country. What has during recent years come to be generally known as the "Santa Monica system" is being adopted as a model, with minor changes and amendments to meet local conditions. The system of constructing oiled-dirt roads has proven so popular, owing to the ease and cheapness of the improvement, that Santa Monica is called upon almost every day to explain the details of the work to good roads committees, highway engineers and city officials from near and far. In this system the heavy asphaltic oil used with so much success on the boulevards of Southern California is incorporated with the dirt found in situ in the roadway, by plowing, harrowing, watering and finally compressing by a tamping roller.

The detailed specifications under which the roads are constructed provide that after the grading of the street or road shall have been completed, the surface is to be plowed to a depth of 4 inches with a turning plow and graded evenly so as to conform to the crown. All clods are to be pulverized and the surface cultivated and harrowed until it shall be of an even consistency throughout.

After the grading and harrowing is completed the next process consists of sprinkling the street with water. Then it is cultivated and harrowed until the surface is wet to a depth of 4 inches, when the oil is applied. Two-thirds of the whole amount of oil to be used on the work is spread evenly over the surface to be oiled. The spreading is done by an ordinary wagon sprinkler. The oiled surface is then turned under by plowing to a depth of 4 inches with a 14-inch plow. Then the plowed surface is thoroughly harrowed along the length and diagonally across. The street is again cultivated until its surface is restored evenly to the proper grade and thoroughly pulverized, when it is again thoroughly sprinkled with water. Next comes the tamping. This is accomplished through the use of a heavy roller thickly studded with blunt-ended iron spikes. This tamping is continued until the base is solid to within an inch of the surface. Once more there is a thorough sprinkling with water. Gravel to the depth of one and one-half inches is then spread evenly over the road, when the remaining one-third of the oil is applied. The cultivating and harrowing is renewed until the oil is thoroughly mixed with the gravel. The roadway is then tamped solid, being wet with water until the surface becomes hard. A layer of gravel is applied, the road is again sprinkled, and a solid roller with smooth surface completes the job.

Three gallons of crude petroleum are used to each square yard of paving, on heavy soil consisting of clay or compact loam, and where the soil is light sand or gravelly, there is an added half gallon of oil for each square yard of road to be improved. The oil used is petroleum, from 12 to 15 degrees Baume test, at a temperature of 60 degrees Fahrenheit, and must con-

OILED STREET AT SANTA MONICA, CAL.

tain not less than 70 per cent. of pure liquid asphaltum natural non-processed oil.

Experience has demonstrated that the cost of grading, oiling and graveling under these specifications is about 4 cents per square foot, the exact cost depending upon the amount of grading and the varying price of the oil required.

Under another class of specifications no gravel is used, but instead the street is plowed to a depth of 8 inches and tamped with the roller tamper to form a solid base up to 4 inches from the top. In this form of improvement about three gallons of crude oil are used for each square yard of road to be paved. After two-thirds of the entire amount of oil to be used has been tamped solidly to within one and one-half inches of the top, the remainder of the oil is evenly spread over the surface and tamped until the entire surface is uniformly hard, when it is rolled with a smooth roller. Work performed under these specifications is done at a cost of approximately three cents per square foot.

A MUNICIPAL ABATTOIR IN SOUTH AFRICA.

By R. A. Webster, Town Engineer, Krugersdorp, S. A.

MUNICIPAL abattoirs, although having been brought to such perfection in Europe, have, until quite recently, been non-existent as far as South Africa is concerned.

The Krugersdorp Municipal Council has just opened the first public slaughter house in South Africa, and by so doing has given the lead to many larger towns. Public interest has been aroused, with the result that already a number of towns have taken the matter in hand, and, if they have not already passed plans for buildings of this description, have signified their intention of doing so.

Municipal control of slaughter poles, by which the meat can be thoroughly cleansed and inspected, will go far to prevent meat going bad (as it does so quickly in a climate like that of South Africa) and afterwards being sold for human consumption. Public opinion has been vented in the columns of the newspapers of the Transvaal and elsewhere, condemning the primitive methods which were in vogue in Krugersdorp prior to the erection of the abattoir, and are common in most South African towns, so that the step taken by the Krugersdorp Council will prove itself to be one on which the ratepayers will have reason to congratulate themselves.

The abattoir which has been erected at Krugersdorp is in no way to be compared with the great public slaughter houses built elsewhere, but fully meets the needs of a town of its size. It has been erected on an elevated site south of the sanitary compound, about three-quarters of a mile from the

town. There are no buildings in the immediate vicinity, and the site chosen is an ideal one from every point of view.

The building, which has been designed on what is known as the common hall system, which allows of the slaughterer being well supervised and the place of killing more easily cleansed, is divided into three compartments, having the killing hall in the center and hanging rooms on either side. The killing hall, which is 40 feet by 35 feet, is designed so that four oxen can be killed at the same time, and will in no way interfere with the killing of smaller animals.

There are four large swinging cranes, designed on the cantilever principle, upon which the animals, after being killed, are hoisted. They are then cleaned, skinned and properly dressed. The crane is then swung to one side and the carcass lowered onto an overhead movable trolley, on which it is taken into one of the hanging rooms, and, when stiff, is cut up and placed upon the steel hanging beams. The internal walls are treated with white glazed tiles to a height of 5 feet, above which the brick work is painted.

The ceilings are of pressed steel, and the roof principals are also constructed of steel. The only wood work in the building is in the windows and doors, which have been enameled. The windows are placed above the tiles, the top part of which can be opened or closed mechanically. The floor is of concrete and is properly drained. The hanging rooms, which are on either side of the killing hall, are 35 feet by 25 feet, and have been treated in a similar manner to the killing hall. On the south elevation platforms have been erected outside each door, so that meat can be easily conveyed to the butchers' vehicles. In each of the hanging rooms are steel hanging beams, which are capable of taking a large number of carcasses.

Great care has been taken to supply sufficient light and adequate ventilation, and special attention has been paid to the drainage. Water has been provided from the municipal mains, which will facilitate cleansing operations.

The abattoir has been inclosed by a strong wire fence, around which trees will shortly be planted. Cattle and sheep pens and pigsties have been erected on the southwest corner of the inclosure, these being provided with concrete floors. At the east side of the main building a boiler and scraping table for pigs have been provided.

There were a few difficulties which had to be overcome when the idea was first discussed, such as regulations and charges governing abattoirs, and these had to be drafted to suit the locality. Another difficulty was the fact that there are no firms in South Africa who make a specialty of abattoir machinery, and, as there was no time to import what was required, it had to be designed and manufactured locally. Up to the present this has worked well and with good success.

The abattoir has been inspected by the assistant medical officer for the Transvaal, and by deputations from other municipalities, including Johannesburg, Pretoria, etc., as well as by the Municipal Commission, and on all sides it has been voted a useful and admirable building.

There was some objection by the local butchers at first to using the abattoir, but this has now died out. All the killing is properly supervised, and before the meat is sent out it is inspected by either the medical officer of health (Dr. Gem) or by the chief sanitary inspector (Mr. Munsie), to whom great credit is due for the efficient manner in which the buildings are managed and the regulations carried out, and the council is being well repaid for erecting the first municipal abattoir in South Africa.

The entire cost of the building and outbuildings is about $15,500, the contractors being Messrs. Birnie Brothers, of Krugersdorp.—*The Surveyor.*

THE STATE'S NEED OF A COMMISSION TO STUDY MUNICIPAL PROBLEMS.

By C. J. Crawford, Cape Girardeau, Mo.

THE greatest failure of our entire system of government is in its control of the municipality. This is, however, the only branch of our system of government with which I have ever had any official connection, but if there is any other branch of our government in any worse condition than this, may God help us!

The letter carrier is the sole and

only representative of our federal government that comes in daily contact with the masses of our people. The state itself has no direct representative that has as close contact with the people as the letter carrier. But the municipality comes in daily contact with every resident of the city. It affords us the streets we ride and walk upon, water, heat, light, sewers, garbage disposal, public safety against thieves and outlaws, the good order of the community, fire protection, protection against ravages of disease, means of education, public parks for recreation, our telephone, our telegraph. It would be easier to tell what the municipality does not figure in. It is the branch of government that everybody thinks he can run, but in fact it comes nearer running itself than any other. It has grown up with a few well-defined, fundamental laws, that are followed indifferently, more as local sentiment may demand, than any one executive requires or assumes responsibility for.

To the high standard of our American people, in their lives, habits and honesty, is due whatever efficiency our municipal government has attained.

We all believe that our government is democratic in form. Generally speaking, this is true, but that of a municipality is certainly most undemocratic, in that the people of the state arbitrarily attempt to govern the city. Add to this the general incompetency or insincerity of our elected authorities, legislative as well as municipal, and season the mixture with a dash of politics and graft, and you have the muddle of municipal government.

In a democratic government the people governed are the source of power. The United States derives its power from the people of the United States. A state derives its power from the people of the state. The line between the nation and the state is very clearly defined. Each has its separate sphere and both are creations of the people.

The tenth amendment to the Constitution of the United States reads as follows: "The powers not delegated to the United States by the Constitution nor prohibited by it to the states are reserved to the states respectively or to the people."

Our forefathers, in the framing of the Constitution, did a wonderful piece of work. Little did they dream that the Constitution they were framing would, in the course of one hundred years, become the backbone of the greatest republic on earth. Municipal problems in those days virtually did not exist. In 1790, when the first United States census was taken, three out of every hundred of population lived in cities. Greater New York is more populous to-day than the whole United States when George Washington was first elected President. Philadelphia was then our greatest city, with a population of less than 43,000 people, and to-day the city of Greater New York employs in its municipal government over 50,000 people, administering to its population of over 4,000,000 souls.

Had the municipal problem existed when our forefathers framed the Constitution it is beyond all doubt that they would have made our whole system of government absolutely democratic in form, rather than making the municipality the agent or ward of the state. Our cities would be to-day doing those things that were reserved by tne Constitution "to the people;" they would be a body politic, governed by home-made charters in so far as dealing with those things which purely concern the people of the city.

In the present legislature of Iowa, 158 in Senate and House, the addresses of its membership run as follows: Forty members in cities of 4,000 population or over; sixty members in towns of less than 4,000 and over 1,000 population; fifty-eight members in towns of less than 1,000 population. The given occupation of sixty-three members of the legislature is farming. This is the body of supreme power in municipal government.

In truth, the once simple life of our farmers has undergone many changes. In these strenuous days of interurban lines, telephone, rural mail deliveries and daily newspapers, his resting hours are spent in politics, and no doubt it has paid him, judging from our agricultural development. Municipal ills have naturally never worried him. Instead, agricultural development, cheap transportation of his produce, improvement of his social conditions, appeal to him as the paramount questions requiring reform legislation. With a legislature composed of 40 per cent. farmers, and, say, another 40 per cent. representing divers personal and selfish interests hostile to the municipality, perhaps seeking to accomplish those things through the legislature that they cannot carry through the city council, is it any wonder that our state laws make certain things lawful in one city and unlawful in another in the same state? Is it any wonder we devote annually millions of public moneys to the technical study of agri-

culture and the control of railroads and other corporations, and nothing to the study of municipal problems?

What legislature has the intimate knowledge of conditions necessary to solve the municipal problem? How can this municipal muddle be cleared up and fairly and honestly dealt with without first creating some state department of authority, competent and capable, to study at least its technical features? How can either a legislature or a city council judiciously enact laws for the government of our municipalities without first having a comprehensive knowledge of the exigencies of the case or the limiting conditions?

THE BRIDGES OF GRAND RAPIDS, MICH.

THE accompanying photographs, for which we are indebted to L. W. Anderson, city engineer, show most of the varieties of city bridges in use.

The first picture gives a general view of the Wealthy avenue bridge, a steel truss bridge with one fixed span, a draw in the form of a swing span on a circular pier in the middle of the span, and a short reinforced concrete arch. There seem to have been many troubles in constructing this bridge. The contract for the sub-structure was let in 1902, but the contractor failed and the construction was assumed by the city in 1903. High water in 1903 and 1904 greatly delayed the work, which was not completed until August, 1904. The piers were increased 2 feet in height to bring the superstructure well above the high water of that year. The total cost of the sub-structure was $25,297.59, including the work included in the original contract, engineering, inspection, extras and the increase in height of the piers. The contract for the steel superstructure was let in 1904. It consists of one 180-foot fixed span, and the 234-foot draw span, with trusses 24 feet apart, and two 6-foot sidewalks outside the trusses. It was completed in April, 1905, having been delayed by final approval of shop plans, lack of material, and snow. The original contract was for $22,051.32, but an additional $9,525.03 was spent upon it. The original plans provided for closing a part of the channel, but the action of the United States Government required the addition of the reinforced concrete arch span shown next to the draw span in the first photograph and more in detail in the second. The roadway was paved with creosoted wooden blocks in 1905 and 1906, and the approaches were partly filled. Pier fenders were constructed in 1906, and in 1907 completion of the bridge approaches was awaiting decision on plans for taking care of floods in the Grand river, which is spanned by the bridge.

The original contracts for the steel bridge called for an expenditure of about $23,000 for sub-structure and $22,000 for superstructure. The total cost, including additions, extras and supervision, is itemized as follows:

Sub-structure		$25,297.59
Superstructure—		
Contract estimates	$31,576.35	
Roadway paving	4,530.15	
Painting	495.47	
Sidewalks	1,069.41	
Engineering, etc.	936.88	
		38,608.26
Arch span		16,972.55
Fender piers.....		4,360.71
Approaches		5,137.80
Miscellaneous		774.29
Total		$91,151.20

The third photograph shows the Bridge street bridge over Grand river. This bridge is a Melan arch bridge, with one 87-foot span, two 83-foot spans and two 79-foot spans, and has a total width of 66 feet.

The cost of the bridge is itemized as follows:

Original contract.....	$87,300.00
Royalty	2,500.00
Paving, walks and conduits.	7,523.17
Comfort station and subway	842.53
Engineering and inspection.	1,281.00
Approaches	4,862.12
Extras and miscellaneous..	867.77
Total	$105,176.59

Paving of approaches, which was assessed on the adjoining property, cost $2,340.77 additional.

When the 30 feet greater width of this bridge is considered, it compares very favorably in cost with the

Wealthy avenue bridge; but it has no draw span and is shorter by the length of the additional arch in the Wealthy avenue bridge.

The fourth photograph shows a small reinforced concrete bridge built over Indian Mill creek after it was widened and the streets, railroads and levees were raised to prevent flooding of the adjoining property. This bridge cost $6,394.55.

The fifth photograph shows a plate girder carrying the Grand Rapids & Indiana railroad over Turner street. It is of the standard construction for this class of bridge on concrete abutments. It was built by the railroad company and the cost is not given.

THE TRANSMISSION OF TYPHOID FEVER.*

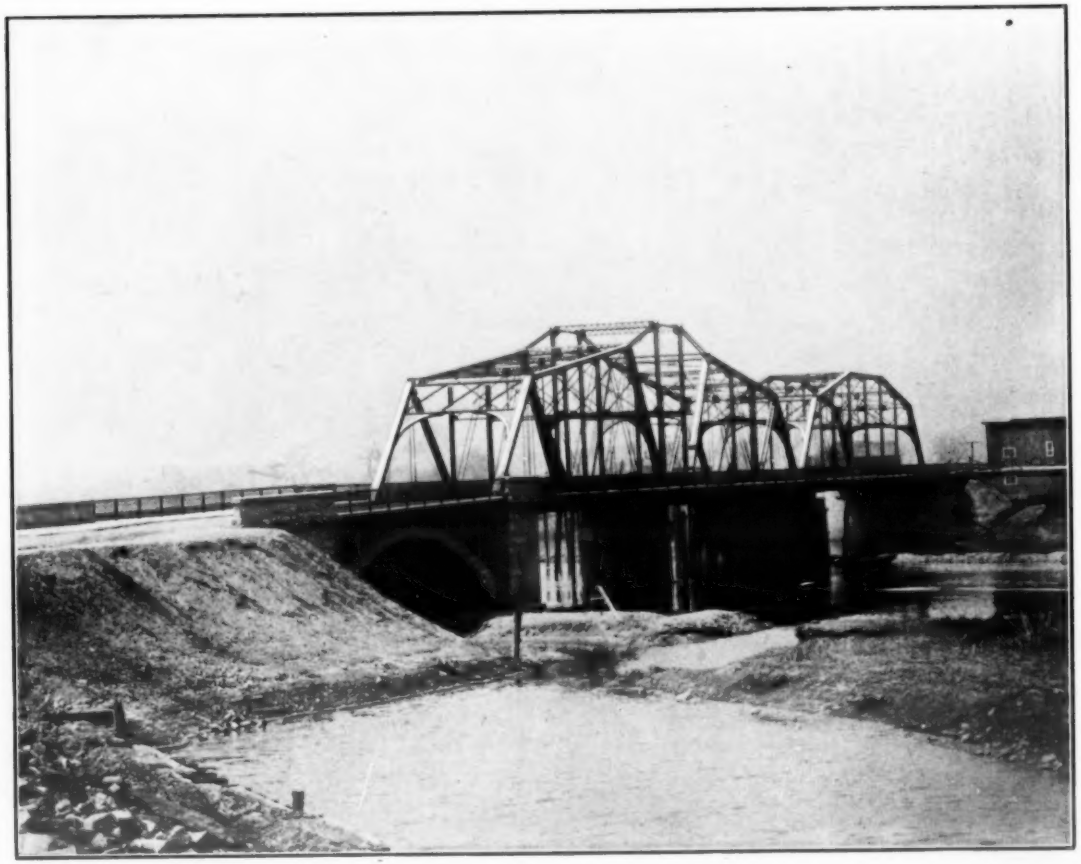
By H. E. Jordan, Chemist of Indianapolis Water Co., Indianapolis, Ind.

THERE may be a question in the minds of some present as to the appropriateness of the discussion of the causation of typhoid fever at a water works meeting; but when it is taken into account that in the minds of the vast majority of people, and a great many people who have written regarding the disease in a few years past, the water has been assigned as the sole cause of typhoid fever, it becomes evident that the discussion of the merits of this matter are worth while in this place. It was as late as June, 1906, that Samuel Hopkins Adams, in McClure's Magazine, made the statement that all typhoid is directly caused by the agency of water, and Dr. Wood Hutchinson, in the spring of this year, stated that 85 per cent. of typhoid is waterborne. Beginning, however, with the studies of Sedgwick and Winslow, in 1902, and following the operation of the Washington filtration plant in the studies that have resulted from the questions raised there, there has been a growing opinion that the liability for typhoid fever has been misemphasized to a large degree, and although there are a number of instances in the past where polluted water supplies have been responsible for epidemics, the steady development of the disease is apparently due to a number of factors. Whatever may be the greatest causative agent of typhoid, it is without question true that its prevalence is too great for sanitarians to accept as necessary. It is worth while to consider for a moment the cost of typhoid fever in order to get the importance of its prevention well fixed in mind. It is a recognized fact that the greater majority of those persons who die from this cause are between the ages of twenty and thirty-five. Basing one's estimate upon the value of human life as given in insurance estimates, the average value in life capital that is thus destroyed is about $5,000.

In the summer of 1907 there were studied in the Seventh and Ninth wards of Pittsburg 194 cases, with especial reference to the actual cost in money expended. These cases occurred in 149 families; from them there were 11 deaths; 87 wage-earners lost 964 weeks' work; care-takers (not professional nurses, but members of the family) lost 182 weeks' work; there were 13 of the cases treated in hospitals; total cost, in these three factors alone, of $24,300. This being proportioned among the 194 cases, amounts to $125 per case, or $2,200 per death. It is without question that the cost more nearly approximates $2,500 per typhoid death on account of the inability of the patient to resume work at his normal rate. This makes a total cost per death of $7,500. There is, then, with the sole question of the money cost in mind, a very deep problem for solution before this one cause of destruction of human life is eliminated.

Typhoid is characteristically a disease of modern civilization, and, in fact, it is apparently not present among uncivilized people. Only as short a time ago as 1830 it was just beginning to be recognized as different from typhus or spotted fever (which, by the way, has within the last few years practically disappeared), but it was not until 1850 that it was understood as an individual and characteristic ailment. The development of knowledge regarding bacterial agency in disease causation, along in the early eighties, brought with it in

*From a paper before the Indiana Sanitary and Water Supply Association.



I. WEALTHY AVENUE BRIDGE, GRAND RAPIDS, MICH.

1884 the discovery of the bacillus typhosus, which is now recognized as the direct causative agent of typhoid fever. There was the opinion for many years that the fever was directly caused by breathing swamp air or living in damp places. There was further the theory advanced by certain French doctors that certain fermentative conditions in the body were responsible for a breaking down of the natural defenses and the onset of the disease.

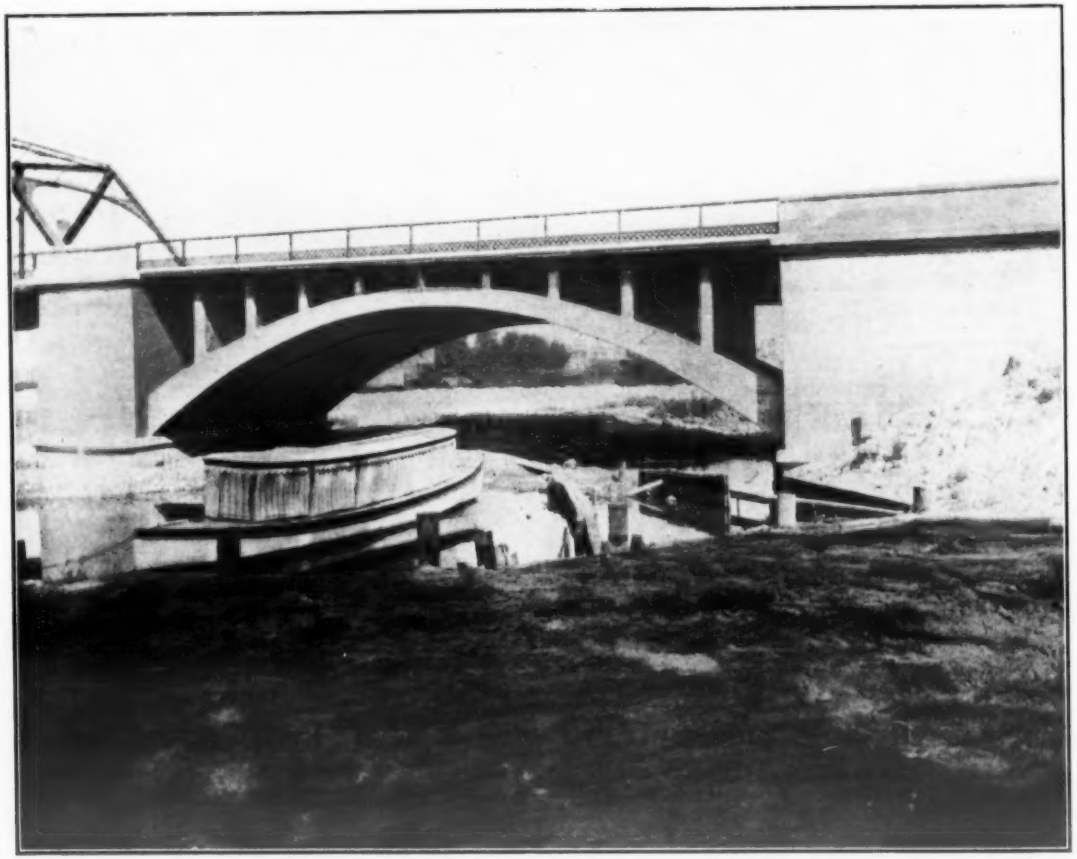
With the development of modern sanitary science it has become understood that there are three determining factors necessary to a case of typhoid: the existence of an infective agent, the germ; a suitable channel for the transmission of the germ to a susceptible individual, and such a condition of vital resistance on the part of an individual as will permit the development of the organism in his body. The first factor—the existence of the germ—has a necessary corollary; no case of typhoid is spontaneous; each is dependent for its existence upon the failure of some previous patient and the attendants to destroy the germs cast off by that person. The escape into the outer world of B. Typhosus from one case is the necessary antecedent of every other case.

It has been demonstrated, within the last few years, that the blood of a person infected with typhoid is filled with typhoid bacilli for a number of days before the patient becomes ill. This has led some to believe that typhoid bacilli may escape through the pores of the skin. Except in cases where typhoid is combined with pneumonia, it is not probable that the coughing of a patient will allow any of the organisms to escape through the mouth. During the period of the fever, and for a time afterward, the excrement of the patient is highly charged with typhoid bacilli, and for six or nine months afterwards the urine is also highly charged with the same. One of the most important discoveries of recent years, in the study of typhoid, is that persons who have had the disease may not only void the infection during this period, but by the germs becoming seated in some organ of the body, the gall bladder or the bladder, although to all outward appearances perfectly well, may continually be giving forth typhoid bacteria, and this condition may not occur only for a short time, but for years—known to have occurred for seven years in the case of the cook at Oyster Bay, Long Island, who infected twenty-seven persons in that time and caused two deaths from the disease. It is by these means that the great spread of typhoid organisms is accomplished, and the step which must be taken to prevent further cases of typhoid is the disinfection of all slops from the patient and the disinfection or burning of all cloths and utensils used in the sick room. The importance of this cannot be overstated, because it is in this one point that rests all future cases of typhoid fever. There is no question that if for one year all cases of typhoid are to be treated in this manner the disease would disappear, and it is simply through the failure to take this precaution that the majority of cases of typhoid are undoubtedly responsible for later ones.

I wish you could get this clearly in mind: that just as if I should level a loaded revolver at this audience and pull the trigger, the bullet speeding from it might strike, injure and cause the death of some of you, so the improperly cared-for typhoid patient may give forth infected matter that may strike, sicken and cause your death.

Unlike lockjaw or bubonic plague, the entry of this organism into the human body may not occur through any lesion of the skin, nor is there any particular reason to believe that, like tuberculosis, it is spread through the medium of the air and wind. The entry of the typhoid organism into the body must be through the mouth, either with food or drink, or by touching some infected medium to the lips. The time elapsing between infection and the noticeable onset of the disease is from eight to ten days. The seat of the disease, as generally understood, is in the small intestine, and consists mainly in the lodgment of the organism in the "peyers patches," as they are called, the production of an inflammation and ulceration, accompanied by high fever, and, in extreme cases, the perforation of the intestine, which is accompanied ordinarily by peritonitis.

An investigation of the typhoid cases in Indianapolis in 1904 discloses the fact that in the great majority of cases there were no attempts whatever at disinfection of slops, and, in fact, there had been no advice on the part of the attending physicians that such a thing should be done. There is no question that the medical profession is largely responsible for the failure to comply with this necessary step, and not until it is recognized by them that this is necessary will the



II. APPROACH TO WEALTHY AVENUE BRIDGE, GRAND RAPIDS, MICH.

steps which have been taken by the boards of health, or those who are concerned in the public supplies of food and drink, be effective.

Keeping in mind, then, the fact that bacillus typhosus is responsible for typhoid, and it is through the failure of persons attending the patients to properly disinfect the slops that the organism escapes into the outside world, it is a matter of interest as to how long it will live outside the human body. Our interest is necessarily directed to things that may themselves, or by their contamination of other things, become a part of that which we take into our mouth, the recognized route of infection. The researches of Jordan, Russell and Zeit, in Chicago, in 1904, disclose the fact that bacillus typhosus will live from three to five days in sewage, and only about 1 per cent. are remaining at the end of ten days in relatively pure water. Sedgwick and Winslow, in 1902, demonstrated that 99 per cent. of the organisms in ice will die within two weeks. In soil the evidence as to its life is not so definite. It, however, appears that there is an inverse relation between the amount of organic matter in the soil and the life of the organism—that is, if the soil is highly charged with nitrogenous matter, just as in sewage, the typhoid organism will die within a short time, but if the soil is somewhat sterile and the organism is allowed to dry, it seems that its life will extend over quite a period. There is, however, this matter to be kept in mind: that the ordinary passage of the typhoid organism from the soil would be through the medium of water washing the ground, at which time it becomes liable to the limitations as to its life in water. The most startling facts regarding the life of the typhoid organism outside the human body are its life in milk. Contrary to the condition which obtains in water and ice, there is not a dying out of the organism, but a very rapid multiplication. Experiments were conducted regarding this last year in Washington, during the study of the typhoid situation there. A sample of milk was inoculated with seventy-eight typhoid bacteria per cubic centimeter, or one-half teaspoonful. Within twenty-four hours there were 60,000 of the organisms present, and within forty-eight hours 10,000,000 per cubic centimeter. When it is taken into account that within the twenty-four and forty-eight-hour periods are the times at which milk is used for human consumption, and that it is taken, in the vast majority of cases, in the raw state, with no effort to destroy the bacterial life present, it is plainly evident that the milk that is infected with typhoid at its source will, by the time it reaches the ordinary city consumer, be an extremely dangerous article of human food.

Uncooked food may, by its previous contact with infected soil or water, be tne abiding place of typhoid germs at the time of its consumption.

The fact that typhoid ordinarily is most prevalent during the late summer months has occasioned its study in reference to seasonal distribution. Sedgwick and Winslow, in 1902, after extensive researches, reached the following conclusion:

"The bacteriology and aetiology of typhoid fever both indicate that its causal agents cannot be abundant during the colder season of the year.

"The germs of the disease are carried over the winter in the bodies of a few patients, and perhaps in vaults or other deposits of organic matter, where they are protected from the severity of the season. The number of persons who receive infection from the discharge of these winter cases will depend upon the length of time for which the bacteria cast in these discharges remain alive and virulent. The length of time during which they will live depends largely upon the general temperature; as the season grows milder, more and more each crop of germs set at random in the outer world will survive long enough to gain entry to a human being and bear fruit. This process will be cumulative. Each case will cause more secondary cases, and each of the latter will have a still more extensive opportunity for widespread damage.

"The most reasonable explanation of the seasonal variations of typhoid fever is a direct effect of temperature upon the persistence in nature of germs which proceed from previous victims of the disease."

III. BRIDGE STREET BRIDGE, GRAND RAPIDS, MICH.

THE ARC LIGHTING SYSTEM OF PORTLAND, OREGON.

By B. C. Coldwell.

DURING the past three years the arc lighting system of the city of Portland, Oreg., has been entirely renovated. The old system, consisting of 9.6 ampere Thomson-Houston direct current series arc lamps, deriving current from 100-light Excelsior arc generators, driven by means of direct connected D162 600-volt motors, has given way to a modern installation of General Electric magnetite lamps supplied with current from constant current transformers and mercury vapor rectifiers.

The old arc circuits were reconnected for the accommodation of the new lamps, each circuit being arranged for approximately seventy-five lamps, this being the load for which the rectifier sets were designed. The constant current transformers are connected to the high tension feeder system of the Portland Railway Light and Power Company, which operates at a potential of 10,000 volts and a frequency of 33 cycles.

The General Electric Company has made many changes in the mechanism of the magnetite lamp during the transition period, and as all of the improvements have been applied to the lamps in Portland, there are not, at the present time, any of the original type of lamps on the circuit. The mercury vapor rectifier tubes have likewise been greatly improved, and many types of tubes have been tried on the Portland circuits.

A considerable amount of difficulty was experienced with the early lamps; there was not sufficient draft, with a consequent clogging of chimneys and a deposit of oxide on the globes. A better designed fume box has remedied this. The early swinging upper electrode, consisting of a starting and burning sector, has given way to the vertical electrode, which gives much better results. All cracking of globes, due to hot metal being thrown from the swinging electrode, has been obviated by the use of the later electrode.

The lower electrode, or magnetite stick, as now manufactured, is giving excellent results. With the original one there was at times a formation of slag which prevented the starting of the arc until the slag was broken. Some trouble was occasioned by the blowing out of the arc by air currents over the top of the globes. This has been done away with by putting a piece of felt on the pan for the globe to cushion on.

The lamp gives an excellent white light and possesses that characteristic most valuable to an arc lamp for use in lighting streets, namely, its maximum candle power is in a direction only a few degrees below the horizontal. This gives it penetrating quality, especially valuable in a city with many trees and much heavy foliage.

The magnetite sticks burn on an average about 170 hours for one trimming. The maintenance expense of the lamps is very much less than that of the old Thomson-Houston lamp, and one repair man is doing all of the repair work on the entire installation of about 1,600 lamps.

The tube transformers used are of the oil-cooled constant current type. Current from these transformers passes through the rectifier tube and then to the circuit. When the rectifier system was first put into operation a single tube was used with each transformer. It was found, however, that a single tube did not work satisfactorily on a circuit with seventy-five lights, and therefore two tubes have been installed in place of the one, the voltage on each tube being thereby cut down one-half. The tubes are mounted one above another on the top of a plug-board panel, and current is carried to them from the transformer by means of cambric insulated cable.

The first sets installed had a reactance for the rectified current, and also two alternating current reactances, the latter having since been eliminated.

When the tubes were first installed a good deal of trouble was occasioned by static on starting, but this has now been practically overcome; experience has shown how it should be handled. Temperature and weather conditions affect the operation of tubes somewhat, and it is therefore necessary that air which is used for cooling purposes be given considerable attention. The operators are now well posted on all conditions affecting the operation of tubes, and can tell at a glance whether a tube is running too cool or too hot, and just what steps should be taken to correct the difficulty. The vacuum in an old tube is not so good

IV. TURNER STREET BRIDGE, GRAND RAPIDS, MICH.

as in a new one, and in order to get results it must be watched a little more closely than the new tube, especially when starting. There is nothing about the operation that cannot be readily understood by any station operator.

The average life of the tubes is now about 1,100 hours. The record tube of the plant has already burned 3,070 hours, and is still operating satisfactorily. The tubes punctured per lamp per month on the Portland circuits is .008 tube. For blowing purposes for the two-tube outfits we find 5.5 watts are required per lamp.—*General Electric Review.*

THE EFFECT OF AUTOMOBILES ON MACADAM ROADS.*

By Logan Waller Page, Director U. S. Office of Public Roads, Washington, D. C.

IT is to Tresauget, engineer-in-chief of the District of Limoges, that we are indebted for the first scientific treatise on broken stone road construction. He clearly specified several types of broken stone roads, one of which, in quite general use throughout England and America to-day, is known as the Telford road. It is a matter of interest that while roads of the Tresauget type are in extensive use throughout England and America, they are rarely seen in France, the macadam type having almost superseded it. Tresauget's report to the Council of Bridges and Roads, written in 1775, on road maintenance, is, in my opinion, the best ever written on the subject. Following Tresauget, McAdam made his splendid contribution. Since the time of these great engineers many improvements and modifications have been made in road building, the most important of which have been largely brought about by time and labor-saving machinery.

It is not my purpose to consider the history of road building, and I have only alluded to it for the purpose of showing that the broken-stone road of to-day has been of slow development. Although the methods of construction vary somewhat in different countries and different localities, the main object sought has always been the same: to withstand the wear of iron-tired horse vehicles at a reasonable cost. Until the last decade these conditions have been successfully met, and the broken-stone road was all that could be desired. Under modern motor traffic, however, the conditions have changed. Roads which formerly withstood the wear of horse vehicles are now quickly denuded of the fine binding material, and become loose and disintegrated. On the principally traveled roads the great clouds of dust raised by rapidly moving motor vehicles are not only a great waste of the material of which the road is composed, but this dust is carried by the wind and disseminated over adjacent property to such an extent that it has, in many instances, affected the value of real estate as well as the comfort of near-by residents and pedestrians. The road surface becomes so loosened that water makes its way to the foundation, and in general the cost of maintenance has very greatly increased. With a constantly increasing motor traffic these are, briefly, the conditions we find to-day, and which have to be met. The problem is such a serious one that it has called forth the best efforts of highway engineers in every civilized country. By the proper use of bituminous materials, the mechanical difficulties have in a large measure been overcome, but the cost of such treatment is so great that it is hard to believe at present that such methods can ever be generally usesd on the many thousand miles of rural highways affected.

As already stated, the broken-stone road has been developed to withstand the wear of iron-tired horse vehicles, and has met successively the demands of suburban and rural traffic until the advent of the motor vehicle. When in its highest state of perfection the rock from which such a road is made is so suited to the volume and character of traffic which passes over it that the amount of dust worn off is only sufficient to replace that removed by wind and rain. The dust remaining should be just enough to bond the surface stones thoroughly, forming a smooth, impervious shell. A road of this character wears uniformly under the traffic for which it was designed,

*An address before the Buffalo Legislative and Good Roads Convention.

V. TURNER STREET SUBWAY, GRAND RAPIDS, MICH.

and when properly maintained always presents an even surface.

When such a road is subjected to continuous fast motor traffic entirely new conditions are brought about. Since the advent of this new traffic its effect on the road has been the subject of much study by both highway and mechanical engineers, and many highly interesting and ingenious theories have been advanced to account for the injury to roads derived from it. While the slipping of the tire, skidding, shape of car body, suction and other causes contribute more or less to the injury of the road surface, I think it is quite generally agreed that the suction of the pneumatic tire on the surface is the main cause of the trouble. The object of this paper is to show, however, that the great tractive force or shear exerted by the driving wheels of motor cars is the main factor of injury.

It has been demonstrated by connecting both front and rear wheels of motor cars with separate speedometers that there is a considerable amount of slipping of the driving wheeels on the road surface, and, on account of the numerous irregularities on the average road surface, this is what should be expected. This slip, due to the decrease in the bearing surface of the tire, undoubtedly increases the amount of finely divided material of the road surface thrown into the air. The increased amount of damage done on this account will be in proportion to the irregularities in the road and the speed of the car. While it is an important factor, its effect is greatly reduced if the road has a smooth surface.

The effect of skidding is only observable on roads that are subjected to a considerable volume of fast motor traffic, and only then on curves. The result of this is to shift the crown of the road tangentially to the gutter. While very annoying to those having the maintenance of such roads, it is not one of the serious or costly causes of injury, as it is generally confined to rather sharp curves.

It is my belief that too much stress has been laid upon the effect of the car body and its shape in removing dust from the road surface. After a number of experiments and observations, I am now convinced that little or no dust is removed from the road surface by this means, except on very dusty roads. The dust lifted by the wheels, however, is greatly accelerated by the action of the car body and the air currents set up in its rear, which has much to do with the dissemination of dust. This is one of the important factors to be considered, as much of the dust lifted by the wheels would not be carried from the road but for the air currents developed by the car body, and these, of course, are much affected by its shape.

Probably no single factor has been considered of as much importance as the so-called suction of the pneumatic tire. Some writers have even gone so far as to maintain that a slight vacuum is created in the rear of each tire, which is sufficient to lift the finer particles of the road surface in the air. In my opinion, entirely too much importance has been given to this phenomenon, for if it exists at all, its effect is probably so slight that it can be considered a negligible quantity, and I shall endeavor later on to give my reasons for this view.

Beyond a doubt the most injurious action of motor traffic is the great tractive or shearing force exerted by the driving wheels of these cars. The fine dust which ordinarily acts as a cementing agent to the road surface is thrown into the air, to be carried off by the wind, or that remaining on the road is so loosened that it is easily washed into the gutters by rain. The pneumatic rubber tire wears off from the broken stone of the road little or no dust to replace that thus removed, and the result is that the stones become loose and rounded, giving the greatest resistance to traction and allowing water to make its way freely to the foundation of the road.

For the purpose of studying this phenomenon I recently conducted a series of tests with motor cars of various shapes and sizes, from the 4,000-pound limousine to the small runabout. These cars were run at various rates of speed, and their effect studied on a section of average broken stone road. The most interesting result was obtained with a 60-h.p. car stripped for racing. The wheels of this car were 36 inches in diameter, with 4-inch front tires and 4½-inch rear tires. The weight of the car, with driver and mechanism, was 2,800 pounds. This car was driven over a level section of broken stone road at speeds varying from five miles an hour to sixty miles an hour. The road used was a section of a government road which had been resurfaced two years previous to the test and was in very good condition. Up to fifteen miles an hour little or no effect was produced on the road, and even at twenty miles an hour it was judged by those pres-

ent that no serious damage was done. From twenty miles an hour on, however, the effect was markedly noticeable with each increase in speed. At a point on the road designated for the proper speeds, photographers with the necessary high-speed cameras were stationed for the purpose of taking photographs from different points of view of the effect produced. These photographs, I think, illustrate the action of the wheels very clearly. They show the car traveling at various rates of speed from five miles an hour to sixty miles an hour.

The chief point of interest in these photographs is the difference in effect on the road between the front and rear wheels. Now if it is true, as has been claimed, that a vacuum is formed in the rear of the pneumatic tire, or that it possesses any power of suction, this should be equally true of both front and rear wheels. I am convinced, after most careful observation, that this is not the case, and I think this point is illustrated by the photographs.

To sum the matter up briefly, the pneumatic tire or any type of tire which propels a vehicle, must have sufficient tractive resistance to overcome the load of the vehicle. This of necessity must cause a shear on the road surface, which varies with the weight and speed of the vehicle. The broken-stone road surface has little power to resist a shearing stress, consequently the fine material of which it is composed is thrown into the air. Once lifted from the road, this fine material is subject to the effect of air currents generated by the car body, and subsequently by the wind. In this manner large quantities of the material of which the road is composed are carried from the road and must eventually be replaced, or the road will rapidly deteriorate. This action may be greatly accelerated by other causes, but in the main it is sufficient to account for the observed results. Aside from the dust carried from the road in this manner, this shearing force of the motor car has a decided disintegrating effect on the surface of the road.

A NEW JERSEY MACADAM ROAD.

EDITORIAL COMMENT

Methods of Sewer Purification.

Effect of Tar Macadam on Trees.

State Control of Sewage Disposal.

When Is a Compliment?

METHODS OF SEWAGE PURIFICATION.

The English Royal Commission on Sewage Disposal issued its fifth report during the past month, in which it states many conclusions and makes recommendations regarding methods of treating sewage that will be of interest in connection with the description of the new sewage disposal plant at Columbus, O., given elsewhere in this number of MUNICIPAL ENGINEERING. The statement of conclusions will be particularly gratifying to the designers of the Columbus plant, because it follows so closely the lines of their work and justifies so fully their decisions.

The Local Government Board is a body which has control of the expenditures of the cities in England, and to which plans for improvements must be brought for approval. This board is properly very conservative, and, following the conclusions of investigations made many years ago, has demanded provision in all sewage disposal plans for final treatment of the effluents on land before discharge into streams. The improvements in methods of tank treatment and filtration have not been accepted by this board, and the commission making this report was appointed to make further investigation. Doubtless the report will be made the basis for a change of practice by the Local Government Board.

A brief statement of the commission's conclusions will be sufficient at this time.

The broad statement is made that there is no essential difference between treatment by artificial filters and on land and that it is practicable to purify sewage to any required degree by either process.

It is generally desirable to remove grit and suspended matters before the land or filter treatment by two or three hours' settling, the exact time to be determined by sewage composition. Filters of fine material require ten to fifteen hours' settlement. The tanks should be cleaned at least once a week. Septic tanks in which the sewage is retained 24 hours will digest about 25 per cent. of the organic solids without decreasing the bacterial content, and the effluent is not more easily oxidized in the filter than that from sedimentation tanks or chemical precipitation. At few places should the sewage be retained more than 24 hours or less than 12 hours in the septic tanks. They may be closed or open, except where nuisance from odors may arise. At least two tanks should be provided. Small tanks may run without cleaning so long as the suspended matter carried over does not clog the filters. Large tanks should have small quantities of sludge run off frequently. The septic tank effluent is greatly improved if it is treated in a tank with capacity for 6 hours' flow, with 2 to 3 grains of lime per gallon, by reducing the suspended solids and increasing the rate at which the effluent can be run through the filters. It is also much less offensive. Certain trade wastes in the sewage and strong sewage from water-closet towns make some chemical precipitation desirable, with 8 hours' flow through the tanks or 2 hours' absolute settlement. Times are subject to considerable variation, according to conditions of the locality, also proportions of chemicals, rates of flow, rates of filtration, etc. There is little difference in cost of the various tank treatments if the differences in filter construction to correspond are taken into account.

Within the recommended limits for depth of filtering material of 2.5 and

6 feet, the depth of a contact bed makes practically no difference in the efficiency per cubic yard, the purification being the same in filters of any depth of coarse material between the limits, if the application of sewage is at the same rate per cubic yard of filter. If the filtering material is fine, the same statement would be true if the sewage were free from suspended and colloidal solids and the aeration of the bed can be thoroughly maintained, but under ordinary working conditions a filter with fine material should be shallow rather than deep. A cubic yard of a percolating filter will generally treat twice as much sewage as a contact bed, there being exceptions when the bacterial life is interfered with by the condition of the sewage. Percolating filters will take better care of variations in flow than contact beds, and their effluents are usually much better aerated, but the risk of nuisance from odors and flies is greater.

Where the soil is well adapted for sewage purification the effluents from land treatment are better than from artificial filters, but in clay and other unsuitable soils they may be very impure. Ordinarily there is no essential difference between the results of the two processes.

The disposal of sludge, where the stream is too small or the filling of mill ponds results, should be made according to special instructions from the central body in each particular case and the cost properly distributed. Apparently the sludge can ordinarily be discharged directly into the stream.

Trade effluents interfere with or retard the purification processes more or less, but, except in extreme cases, do not make either artificial or land treatment impracticable. In such extreme cases preliminary treatment of the trade waste before discharging it into the sewers may be necessary.

A comparison of this program with that provided for Columbus shows that they are very near together. Should the Columbus tanks operate at the rate for which they are designed, the time of retention in the tanks would fall between the maximum for sedimentation tanks and the minimum for septic tanks above named. For some time, however, it will be possible for the Columbus tanks to be operated either way, so that the most advantageous period of retention can be determined. It should be remembered that, according to the data collected in MUNICIPAL ENGINEERING, vol. xxxiv, p. 236, the period of passage through septic tanks, according to American practice, is about two-thirds the English practice, or 8 to 16 hours, as compared with 12 to 24 hours. The character of the filter beds, their depth, the discharge of effluent and sludge into the stream, all agree with the above statement of the best English practice. As the largest yet constructed in this country, the Columbus plant will be observed with great interest, particularly since the character of sewage and the climatic conditions in this country differ very perceptibly from those in England, and the character of modifications of good English practice made necessary by them will be the important question. The plant is completed, with the exception of some of the connections, and controlling piping, valves and apparatus, and the time of beginning operations will not be long delayed.

EFFECT OF TAR MACADAM ON TREES.

A rather sensational report from France has been traveling through the newspapers to the effect that the tarred roadway on the Avenue du Bois de Boulogne has been responsible for the death of eight fine trees along its line and the withering of flowers and grass, on account of the action of fine particles of tar thrown on them by fast-traveling automobiles. There are said to be also petitions from fruit and vineyard districts in the country regarding the bad effects of tarred roads upon vegetation.

The use of tar for treating road surfaces is perhaps more general in England than in any other country. There are many patented processes and mixtures and machinery for applying them in use in that country. *The Sur-*

veyor and Municipal and County Engineer has taken up an inquiry regarding this question, and in numbers appearing in September gives reports from many county, borough and city engineers regarding their observations.

Very few have noted any deleterious effect of the improved roads upon vegetation, and these attribute the injury to vegetation and trees to the close proximity of the roadway to them and the reduction in the water supply to tree roots by rendering the road surface waterproof and extending this surface so as to prevent the passage of water into the soil in the vicinity of the trees. Nearly all who report actual experience report no perceptible effect of tarring the roads upon the adjacent vegetation, although some such roads have been in use for five years.

It is quite probable that the petitions referred to are against the dust nuisance on roads, as the reported rapid destruction of French roads by the enormous automobile travel on them has undoubtedly vastly increased the amount of dust raised by them and carried by the air to the surrounding fruit trees and grape vines. This increase in dust and the almost simultaneous appearance of some tarred roadways may have led uninformed observers to attribute wrongly the effect of dust to the tar, which is intended to remove it.

No such reports of damage have been received from tarred roadways in this country as yet, although there have been some similar complaints from oiled roadways. These complaints have been stopped by doing the oiling and the subsequent treatment properly.

STATE CONTROL OF SEWAGE DISPOSAL.

Several states have now taken the problems of water supply and sewage disposal more or less completely under their control. Thus far the boards or commissions to which the administration of the laws has been intrusted have been progressive bodies, and some of them have been provided with funds enough to carry on more or less elaborate experiments and observations, so that they have kept quite in advance of the ordinary engineering and sanitary practice. There are even now some indications of growing conservatism which make it worth while to call attention to some of the effects of excess in this direction, as hinted at in the recent report of the English Royal Commission on Sewage Disposal.

The English Local Government Board has control of the making of loans by the municipalities of the country, and requires full information concerning the use to be made of the money before giving its sanction to the expenditure. With reference to sewage disposal there has been complaint for many years that this board was retarding the advance of the science of sewage purification by its requirement of final treatment on land in all cases coming under certain definite rules and statutes, without reference to the purity of the effluent coming to the land from other sewage purification plants. Local conditions and the differences in the necessities of the cases seemed to have no consideration.

The Royal Commission on Sewage Disposal was appointed several years ago to investigate existing methods of sewage disposal and has made several reports. While this year's report is not final, it gives some recommendations and conclusions which are practically final in their form of statement under the present state of advancement. Some of them are stated in another article in this department.

One of the commission's most important recommendations is to the effect that the economical discharge of the duties of local authorities requires such change in existing laws and rules as shall make it possible to take local conditions into account. Accompanying this recommendation is the equally important one that the central controlling body shall be supplied with funds and authority and shall be required to make such investigations, experiments and observations as shall be sufficient to determine the economy

as well as the efficiency of methods of sewage disposal and their application to the conditions in each locality as to both these elements.

The report cites among the more important questions which have to be dealt with under the new conditions of administration contemplated the following:

(1) Disputes between local authorities and manufacturers as to the terms and conditions on which trade effluents shall be admitted into sewers.

(2) The control of shellfish layings, so as to prevent the taking of shellfish for human consumption from positions in which they are liable to risk of dangerous contamination.

(3) The protection of water supplies from pollution.

(4) The collection of information as to the water supplies available in various parts of the country.

(5) The collection of information as to the need of water in various parts of the country.

(6) The settlement of standards for different reaches of water.

(7) Conferring powers on local authorities, in suitable cases, to provide separate systems of sewers for surface water and to enforce the provision of separate drains.

(8) The settlement of questions as to the extra amount of sewage which a local authority should be required to treat during storms.

All these are intended to loosen up the conservatism of the central controlling body and induce in it a spirit which will tend to keep it up to the times.

The writer has met in his experience several instances on a smaller scale of similar tendencies toward conservatism in similar bodies in this country, which, if permitted to develop, would limit progress seriously. The emulation of the departments in the various states will check excessive conservatism, but it will not remove all the inequalities and injustices. The fact that one of the instances suggested was in the provisions of a recent bill introduced in a state legislature shows the need of great care in putting together the machinery through which the state authorities corresponding to the English Local Government Board will do their work.

The English Board has charge of many lines of municipal effort through its control over their finances. Perhaps our American method of distributing the work among several boards is an improvement in that it gives each board its specialty and there is less tendency to drop into formal methods of passing upon questions on which many members of the board are not expert. However, unless there is a central, unifying force somewhere, the multiplicity of boards will give rise to conflict, duplication and waste. In our future legislation this must be carefully guarded.

WHEN IS A COMPLIMENT?

This magazine has become accustomed to seeing its version of the facts regarding progress in the field of municipal engineering taken bodily and frequently by a few of its contemporaries among the trade papers, without credit of any sort. The facts may be common property and no one can object to the use of them, and one should perhaps not object to the compliment given by the assumption of the dress into which the facts have been put, though the formulation of the compliment be lost sight of in the hurry of appropriation. But when one of our foreign contemporaries more than once takes facts, dress and all and puts them in its editorial columns, the effect of the compliment is fully offset by the assumption of editorial authority for the articles, and calls for some mention.

THE QUESTION DEPARTMENT

Specifications for Board Sidewalks.

Have you ever published specifications for board walks or items on cost of same?
W. A. B., Greenfield, Mass.

In MUNICIPAL ENGINEERING, vol. xxviii, p. 14, will be found an article on "Sidewalk Construction for Small Cities," which gives an abstract of specifications for the construction of board walks and data for making bills of materials. Cost depends so much upon local cost of lumber that even approximate figures cannot be given.

Information About Cement Sidewalks and Municipal Improvements.

Our Board of Trade is considering concrete sidewalks, and, as a member, I wish to obtain all the information I can relative to proper construction and comparative costs. Please give me the names of such periodicals, text-books and associations devoted to municipal improvement that you may possess.
M. D. S., Pulaski, Tenn.

The "Handbook for Cement Users" ($3) gives full descriptions of various methods in use for constructing cement sidewalks and specifications for the same. It also gives data regarding amount of materials and labor required, so that the probable cost can be estimated for any given local conditions.

MUNICIPAL ENGINEERING ($2 a year) is the oldest and the leading magazine devoted to municipal improvement.

Among the books on municipal improvement which probably will meet the desires of our correspondent are Baker's "Municipal Engineering and Sanitation" ($1.25); Whinery's "Municipal Public Works" ($1.65); McCullough's "Municipal Public Works" (50 cents), and "Engineering Work in Towns and Small Cities" ($3). There are many others upon special lines, such as Judson's "City Roads and Pavements" ($2 net); Price's "Handbook on Sanitation" ($3); Mason's "Water Supply" ($5), etc.

The association devoted most particularly to municipal improvement is the American Society for Municipal Improvement, which holds its next convention in Atlantic City, October 20-24. Geo. W. Tillson is the president, Park Row Building, New York City. Every city department in charge of any sort of public improvement should be represented in its membership and at its conventions. Other societies taking up matters of municipal improvement more general in their nature are the League of American Municipalities, John MacVicar, secretary, Des Moines, Ia., devoted more particularly to the legislative side of municipal government, and the National Municipal League and American Civic Association, of both of which Clinton Rogers Woodruff, North American Building, Philadelphia, Pa., is secretary, which is made up largely of private citizens and representatives of civic organizations interested in the improvement of their municipalities.

How to Build Residential Sewage Disposal Plant.

Can you supply me information how to construct a septic tank and filter, the outflow to be used for irrigation, one suitable for family use? Is it practicable to build with concrete? I am located on a side hill.
W. D., San Diego, Cal.

Probably the filtration process will not be necessary in a locality like San Diego, where the effluent from the septic tank can be used for irrigation practically every day in the year. In that case, the residential septic tank described in MUNICIPAL ENGINEERING, vol. xxiii, p. 35, by B. J. Ashley, would be applicable. These tanks are circular, about 3 feet in diameter and the sewage stands in them about 3 feet deep. Inlet and outlet are each of 4-inch pipe, turned down by an elbow so that sewage flowing in and out will not disturb the scum which should form on the surface. The size of tanks is varied to suit the number of persons served, one of 160 gallons capacity being considered by Mr. Ashley to be sufficient for eight to twelve persons. After seven years of use these tanks were reported by Mr. Ashley to be operating successfully. Although the effluents discharge into farm tile drains not originally intended to receive such discharges, there is no complaint of nuisance.

At the last meeting of the American Society of Plumbing Inspectors and Sanitary Engineers, a paper was presented by Henry F. Shade, Vancouver, B. C., in which he described the results of his experiments in the same line. He seems to build his tanks about 3 feet deep, rectangular in cross-section, and about 6 feet wide. He allows 2 square feet increase of area for each person served, more than eighteen persons, and the area is increased by lengthening the tank. Mr. Shade found that the inlet should be turned down and extended about one foot below the overflow level of the outlet, as the scum is not then disturbed by the inflow. Two feet was found to be too great a depth for satisfactory working, on ac-

count of possible stoppage of the inlet pipe at the bend. The outflow pipe is turned down to about the middle of the depth and there is then no danger of drawing off the scum on the surface or the sediment on the bottom. The amount of sewage allowed for was 40 gallons per capita per day, fully double Mr. Ashley's allowance. Mr. Shade considers that filters or contact beds are not generally applicable to such small septic tanks on account of the attention they require. He suggests sub-surface irrigation if the soil is sandy and there is no convenient point of discharge for the effluent from the tank. Mr. Ashley says the subsoil irrigation plan will not operate unless a flush tank for intermittent discharge is provided. The writer, as stated above, believes the best results will be obtained by using the effluent directly for irrigation in the particular case under consideration.

Should the subsoil irrigation method be decided upon, a description of the construction will be found in Waring's "How to Drain a House" ($1.25), and a drawing without dimensions, showing a section of septic tank, discharge chamber and automatic siphon, and plan of the distribution pipes for the subsoil irrigation, will be found in Starbuck's "Modern Plumbing Illustrated" ($4), with a description of the design and a discussion of capacity and dimensions.

Mr. Ashley built his tanks with concrete bottoms and brick walls. There has been some question recently of the ability of concrete to withstand the action of septic sewage, but there is no definite information which would show that it is not suitable, and there are many concrete tanks in successful operation. A concrete wall with brick or tile lining would unquestionably be safe.

Sewers Without Water Supply.

I have in hand the design of a system of sewers for a small town in this province not having any public water supply, and, as you will readily understand, am encountering some few difficulties.

Would you have the kindness to refer me to numbers of your magazine, during the past few years, which may contain references to any similar cases which may have been brought to your attention?

G. G. M., St. John, N. B.

A system of sewers means water carriage, except for the one or two former examples of the Liernur pneumatic system. Water carriage requires a supply of water sufficient to do the carrying and to keep the sewer pipes clean. Ordinarily a public water supply is considered to be necessary to operate such a system successfully, but if each house connecting with the sewer system has an ample supply of water of its own, the system can be made to work with reasonable success. Water closets require flushing streams of water, sinks require water to keep them clean, and roof water can be used to give the sewers occasional flushings, if a stream of water is not available to turn into the pipe ends occasionally. Private supplies are ordinarily dependent on manual labor, at least in part, for lifting the water, and so are very liable to be short of the demands of a sewer system, but if the private houses are supplied with attic or other elevated tanks, and wind, gasoline or other power for keeping them full, the sewer system may be as well supplied with water as it would be were there a public supply. There is considerable increase in the use of water when sewer connections are made, and this must be taken into account in predicting the increase in the amount of work the property owner must do to keep his house supplied under the new conditions, otherwise he may shortly fail to keep up his supply and get into sanitary difficulties.

In MUNICIPAL ENGINEERING, vol. xxiii, pp. 355 and 357, are two articles describing two methods of purifying the wastes from single houses and disposing of them, which should be of interest in such cases as this. One of these methods assumes fairly ample supply of water and the other a comparatively small supply. Other articles not directly answering the question, but having some information which may aid in working out the problems involved, are "Sewerage and Sewage Disposal at Bedford, Ind.," vol. xxvi, p. 109; "Sewage Disposal for Small Cities and Towns," vol. xxvii, p. 331; "The Tankage of Sewage," vol. xxx, p. 329; "Sewage Disposal at Downers Grove, Ill.," vol. xxxi, p. 49; "Progress in Sewage Disposal," vol. xxxiii, p. 312. A further list of articles on septic tanks and sewage filters will be found in vol. xxxi, p. 280.

Books on Sewage Disposal.

If you have any up-to-date works on sewage disposal, I would like to have a list, with prices.

F. B. C.,
New Kensington, Pa.

A descriptive list of books on sewage disposal will be found in the list of books on municipal and sanitary engineering printed in MUNICIPAL ENGINEERING, vol. xxxiii, p. 175.

The following list includes these books and some others of later date:

Baker's "Municipal Engineering and Sanitation" ($1.25 net) treats the subject from the point of view of the sanitarian.

Chapin's "Municipal Sanitation in the United States" ($5 net) gives some space to sewage disposal.

Folwell's "Sewerage" ($3) devotes two or three short chapters to the subject.

Starbuck's "Modern Plumbing" ($4) gives some practical directions on the construction of small sewage disposal plants.

Vernon-Harcourt's "Sanitary Engineering with Respect to Water Supply and Sewage Disposal" ($4.50 net) gives modern English practice, and is an excellent treatise on the subject.

Merriman's "Sanitary Engineering" ($2) has one chapter on sewage disposal.

Robinson's "Sewage and Sewage Disposal" ($3) gives brief reports of experience.

Venable's "Sewage Treatment" ($3) is one of the most recent books on the subject and gives reports of American practice and a discussion of the engineering principles on which it is based.

Murray's "Main Sewerage and Sewage Disposal" (25 cents) is a pamphlet which gives a short history of sewage disposal and some detail of settling tanks and sprinkling filters.

Rafter and Baker's "Sewage Disposal in the United States" ($6) is the oldest American book on the subject and is a good record of practice down to 1894.

Dibdin's "Purification of Sewage and Water" ($6.50) may be considered the best book that has yet appeared. It is English and gives English practice.

Baker's "British Sewage Works" ($2) is a collection of short descriptions of English and continental sewage disposal plants, made by an American observer.

Rideal's "Sewage" ($3.50) is an English book devoted to the bacterial purification of sewage.

Barwise's "The Purification of Sewage" ($3.50 net) is a new edition of a standard English book on the subject, which brings it down to date in that country.

Moore's "Sanitary Engineering" ($10 net) devotes about 200 pages to sewage disposal.

Scobie's "Land Treatment of Sewage" ($2 net) is a recent book giving quite full statements of the results of this method of sewage disposal in each of the English works where it is applied.

System of Accounts for Small City.

With reference to the forms of accounts for small cities, discussed in this department in the September number of MUNICIPAL ENGINEERING, p. 177, under the above heading, it is stated that E. L. Barrett & Son, Springfield, O., and Harry Stanage, Cincinnati, furnish books in the necessary forms for the use of the municipal offices in the State of Ohio, under the law in that State providing for uniformity in municipal accounts. There are doubtless others in the State who can supply them.

Use of Tar and Oil on Macadam Roads.

We are more or less interested in the use of tar and oil on macadamized roads, and it has occurred to us that possibly MUNICIPAL ENGINEERING might have something in it along this line which would be of interest to us. If so, will you please advise us?

A. D. LITTLE,
Boston, Mass.

MUNICIPAL ENGINEERING has paid much attention to this subject, and there have been many articles in its volumes almost from the beginning. Following are some of the more important articles in the most recent volumes:

In vol. xxxv: "Progress in Dust Prevention," p. 126.

In vol. xxxiv: "How the Dust Nuisance Can Be Suppressed," p. 250; "Experiments with Tar and Oil on the Highways of Rhode Island," p. 283; "Materials for Tarring Macadam Roads," p. 355; "Efficiency of Tar Macadam Pavements," p. 361, giving a list of previous articles containing full information and specifications for various tar, asphalt and oil treatments of macadam roadways; "The Coming of Dustless Roads," p. 378.

In vol. xxxiii: "Automobiles on Oiled Roads," p. 30; "Pavements of the Future," p. 99; "English Machines for Applying Tar to Roads," p. 110; "Tarvia on Michigan Boulevard, Chicago," p. 202; "Results of Oiling Roads in Kansas City," p. 422; "Dustless Roads in England," p. 20.

In vol. xxxii: "Results of Coating Streets with Tar in France to Eliminate Dust," p. 34; "Tar on New York Highways," p. 122; "Tar Macadam in England," p. 193; "Information about Dustless Roads," giving a long list of articles previously appearing, p. 242; "Reducing Dust and Hardening Roads by Surface Applications," p. 321.

Making Concrete Blocks Waterproof.

I read in a book issued by a firm of architects that concrete building blocks can be made waterproof by placing behind the face a layer of rich concrete and the balance of the block to be filled with a looser mixture. Have you heard of such work being done? If so, have you an article on the subject in your magazine?

R. F. R., Ridgefield, N. J.

To make a concrete block waterproof the voids in the concrete must be filled so that water cannot pass through. If a layer of such waterproof concrete is laid on the face of the block it will protect the whole block from water entering from that side, but the joints must also be waterproof in order to protect the whole wall. One difficulty in rendering machine-made blocks waterproof is the dryness of the mixture which must be used in order to handle the blocks rapidly. Wet concrete, if not too wet, can be made more nearly waterproof than moist, so-called dry, concrete of the same proportions. In the endeavor to make concrete blocks as cheaply as possible lean mixtures have been used, in which the voids in the gravel or stone and sand were not filled by the cement. In the effort to improve these blocks without increasing the cost too much, the richer mixture for a thin layer on the face has been used. If made as moist as possible without sticking to the molds and compacted thoroughly, this expedient is an improvement, for it materially reduces the porosity of the blocks from front to back. Some operators go over the faces of the blocks carefully with trowel or other finishing tool, using possibly a little water or cement grout, and thus close the pores of the surface still

more thoroughly. This, of course, adds to the cost of the blocks, and it must be done by an expert to prevent hair cracks and irregularities in surface and color. Other operators use the various waterproofing substances or processes that are on the market. These include chemicals which modify the action of the cement and close the pores, and substances which act simply as mechanical fillers of the voids in the concrete, or in part as repellers of water. Perhaps as successful a substance as any for waterproofing concrete blocks is the Medusa waterproofing, which seems to act both as a filler of voids and a repeller of the water which attempts to pass through, thus offsetting the capillary action of the infinitesimal openings in the hardened concrete.

In the last volume of MUNICIPAL ENGINEERING, vol. xxxiv, pp. 97 and 301, will be found lists of articles on the subject of waterproofing, most of them on waterproofing concrete blocks and concrete block walls; also in vol. xxxiii, p. 252. Another article on the alum and soap process, as applied to the blocks, will be found in vol. xxxiv, p. 368, and one on the paraffine process on p. 300. An article on "Establishing a Concrete Block Business," in vol. xxxii, p. 88, discusses the necessity of making good and impervious concrete mixtures by using enough cement. An article on "Concrete Building Blocks," in vol. xxx, p. 253, gives full instructions regarding making of blocks, including putting on of facing.

The "Handbook for Cement Users" ($3) also gives instruction on making concrete impervious to water.

Who Makes Plasterer's Corner Beads.

We are in the market for some corner beads that are strictly first-class. To whom can you refer us? We want to handle these corner beads direct from the factory, and not through other parties, as we have got to cut out the middleman in order to compete. We want the best corner bead there is in the market. The Shenango is a good corner bead, but we are unable to ascertain just by whom they are manufactured, and where.

J. H. A., Lincoln, Neb.

Following are names of makers of plasterers' corner beads and the trade names of their products. The maker of the "Shenango" is not known to the writer. Can any of our readers enlighten our correspondent?

Bostwick Steel Co. ("The Bostwick"), Niles, O.

Chicago Builders' Specialties Co. (agents for "Universal"), 138 Washington street, Chicago.

Gara, McGinley & Co. (Woods), 23 South Seventeenth, Philadelphia.

Hunt Metal Corner Co., Westboro, Mass.

Merritt & Co., 1024 Ridge avenue, Philadelphia.

W. F. Parker, 856 Eleventh avenue, New York City.

Penn Metal Ceiling and Roofing Co., Twenty-third and Hamilton, Philadelphia.

J. B. Prescott & Co. ("Prescott"), Webster, Mass.

Rogers-Shear Co. ("Universal"), Warren, Pa.

Union Metal Corner Co. ("Hannon," "Goodwin" and "Union"), 206 Summer street, Boston, Mass.

Thickness of Concrete Block Chimney.

We intend building a chimney of concrete blocks, connected with a heating plant in a hotel building. Chimney to be built on outside of building from the ground up, and against the hotel brick wall. We are not certain if the blocks used for this purpose will be strong enough to stand up. The dimensions are 55 ft. high and a 16-inch flue. Blocks to be 8 by 8 by 18, with two cores, mixed 1 part Iola cement to 4 parts good sand. We have ¼-inch crushed limestone that we might use in the aggregate. Chimney will take about 450 blocks of this size. Will you please advise us by early mail, per the inclosed addressed, stamped envelope if we are secure in going ahead and building? We could make blocks solid.

J. C. B., El Reno, Okla.

So far as crushing strength is concerned the chimney would be sufficiently strong. The effect of wind and unequal settlement must be allowed for if the chimney is not fully protected from them, and in a brick chimney it is customary to make the thickness of the lower half of a 50-foot chimney about 16 inches thick. It would be well to follow this rule in the concrete block chimney, also, and if there is danger of very heavy winds some anchorage would also be advisable. The chimney will not fall down unless it is pushed or blown down, if built of the single row of blocks all the way down.

Makers of Microscopes and Accessories.

Can you give me the name and address of some dealer or dealers in good reliable microscopes suitable for professional and scientific investigation: also dealers in object slides and other accessories for microscopes?

L. C. H., Bellingham, Wash.

The Bausch & Lomb Optical Co., Rochester, N. Y., are well known as makers of the highest grade of optical goods, and particularly for their excellent microscopes. They can probably furnish the slides and other accessories. So can Queen & Co., Philadelphia, Pa., who are dealers in all kinds of optical goods.

Ownership of Stream Bed.

Two men own land on opposite sides of a stream about 50 feet wide, which is filled with a very fine grade of sand. One of the men has made a practice of removing this sand and selling it for commercial purposes. The other man recently sold his property and gave the present owner a deed which reads "to the center of the stream," and the new owner has forbid the other from removing the sand, as his deed only reads "to the stream."

1st. Can the one man legally prevent the other from removing the sand?

2d. Has a man a legal right to deed

property to the center of a stream? If not, how far should he deed it?

3d. Would the stream at low-water mark show the true bounds of each man's land at the stream?

E. J. T., Brooks, Me.

These are questions for an attorney versed in the law of Maine regarding streams as boundaries of land, who can determine the exact status of the case and the application of the law in that state to it.

In general it may be said that one property owner has no right to do anything to the stream, without permission, which will change the conditions with respect to the property adjoining on the opposite side of the stream, and if the removal of the sand would have such effect it could probably not be removed without danger of liability for damages.

Where streams are not navigable and are used as boundaries, each owns to the center of the stream, at least, as determined at the time it was made a boundary. Whether the boundary shifts with the shifting of the stream or not is sometimes determined by other circumstances.

This is true also of the question whether the general bed of the stream or the low-water lines determine the boundary. Ordinarily a sand bar not in the stream at low water is considered to belong to the property on that side of the stream, and can be disposed of as the owner desires, but if its removal should result in a change of the low-water channel, the question of the damage to the opposite property owner would arise.

Usually where the land is not so valuable that the wanderings of the stream are restricted by improving the banks, the center of the ordinary low-water channel is considered as the center of the stream, and the owner on one side could not remove sand on the other side of the center, either directly or by causing it to flow onto his side, but in cases where the banks are improved it is apparently customary to consider the center as midway between the lines of these improvements.

These questions are not definitely settled by rules of law, however, and the Maine customs and decisions should govern in the case of property located in that state.

Will our readers give our correspondent the benefit of their experience?

Effect of Standpipe on Water Pressures.

I would like some information on the question of fire pressure.

Have you any data showing the requirements of different cities and how they average?

Another question: Suppose a pumping station is situated in close proximity to its patrons and the standpipe is located over a mile distant, 110 feet high, on ground 50 feet above the pump station, and supplied from mains which serve the public some 12 to 14 miles, and laterals intervening, with fire hydrants properly distributed. Suppose the standpipe is only half full or two-thirds full and the pump starts up at 80 or 100 pressure and fire plugs are opened, what effect will the standpipe have on the pressure at hydrants? How much less pressure will there be at the hydrants than if the standpipe were closed? Would we not practically get full direct pressure, especially in the business section, which is on a level with station and a short distance from same? R. B., Corsicana, Tex.

In MUNICIPAL ENGINEERING, vol. xii, pp. 2 and 72, will be found tables of statistics of water works plants, one column of which shows the fire pressures. The first table is for cities of more than 100,000 population. The lower limit of fire pressures in these cities runs from 10 pounds to 160 pounds, and the upper limit from 30 to 170. The second table is for cities of 50,000 to 100,000 population, and the lower limit is from 0 to 130, and the upper from 40 to 150 pounds. There is no uniformity of custom, and the pressure in hilly cities varies, of course, with the differences in elevation. Probably the most popular limits for fire pressure in reasonably level cities are 70 to 120 pounds.

The second question can be answered only from a study of the pipe system, checked by some actual tests. If no fire hydrants are open and no water is drawn, the 80 pounds pressure would raise the water about 184 feet, so that it would overflow the standpipe. If fire hydrants are opened near the pumping station, they will take the water, and the pressure of the flowing water would probably not be materially affected by the open standpipe a mile or more away, unless the main from station to standpipe is large and the hydrants are on small branches of some hundreds of feet length. A hydraulic engineer can compute within reasonable limits the pressures at the various hydrants under various assumptions of initial pressures, number of hydrants open and their location, and condition of standpipe. He must have a correct map showing sizes of pipe, connections, elevations of hydrants, etc., as the basis for his computations.

A standpipe at the opposite end of the system from the pumping station acts as an equalizer of pressure for the portion of the system near it. In case of heavy draft, as for a fire, the pressure will be improved until the standpipe is drawn down to the point where the pressure from the column of water is equal to that coming from the pumping station in the other direction. The good effect of a standpipe can easily be neutralized by a bad design of the pipe system connecting with it and served by it.

FROM WORKERS IN THE FIELD

Practical Points from Practical People.

Contributions to this Department are invited. Give from your experience for the benefit of others. No matter about the style of the composition, the fact is what is wanted. Use the Question Department for what you want to know; use this Department for what you can tell others.

Causes of Waste in Water Services and Mains.

The Cleveland, Ohio, water department investigated many cases of large consumption of water during 1907 and determined the reason therefor. The following data are taken from the report for that year, the percentages being added by the writer for convenience in making comparisons:

Cause of Large Consumption.	Services Investigated. No.	Services Investigated. Percentage of Total.
Water closet out of order	425	1.1
Leak at water closet	5,565	14.4
Hopper water closet not self-closing	3,109	8.1
Total difficulties with water closet	9,099	23.5
Leak at urinal	131	0.4
Found urinal running	114	0.3
Total difficulties with urinal	245	0.7
Total urinal and water closet difficulties	9,344	24.2
Leak at street washer	90	0.2
Leak at hydrant	326	0.9
Leak at faucet	2,119	5.5
Leak at beer pump	467	1.2
Leak underground	1,247	3.2
Water used for building purposes	90	0.2
General waste	744	1.9
No leaks	4,521	11.7
Notifications	19,663	60.0
Total investigations of large consumption	38,611	

The preponderance of difficulties with water closets is pronounced, over 63 per cent. of the leaky and wasting connections being affected by closets and about 66 per cent. by closets and urinals together.

While examining service connections in the street and lowering those requiring it 3,907 pipes were found to be tight and 6 were found to be leaking a total of 3,702 gallons per hour, the rate of leakage per connection varying from 10 gallons to 48 gallons in 24 hours, with two running 3,600 gallons together.

Of the 24,273 feet of street mains exposed or lowered at the same time, 2,367 joints were found tight and 8 were found to be leaking a total of 474 gallons per 24 hours, one joint leaking 360 gallons and the remainder being distributed among the 7 other joints.

These figures give some definite data on which to base leakage estimates. They coincide in a general way with the general opinion of water works officials regarding the source of most of the troubles from leakage.

Method of Using Copper Sulphate in Reservoir.

The last report of Emil Nuebling, the superintendent of the Reading, Pa., water supply, contains the following regarding the treatment of one of the reservoirs under his charge with copper sulphate:

"Numerous microscopic examinations of the water in Antietam Reservoir were made during the year in order to determine the number of microscopic organisms it contained. The main object of the examinations was to find the time when the organism anabaena started to multiply, so that the water could be treated with copper sulphate, in order to remove this organism from the water and lighten the work of scraping at the Antietam filters. Between May 4 and July 11, the average number of standard units of anabaena per cubic centimeter contained in the water supplied at the Antietam filters was 14; on July 18 the number had increased to 70; five days later the number was 530; on July 25 the number was 640, and the next day they had increased to 770, when the water in the lake was treated with one part of copper sulphate to 7,170,000 parts of water. On July 27, the following day, no trace of anabaena was found in the water. On August 5 the water was again treated with one part of sulphate to 8,460,000 parts of water. The only anabaena discovered in the water between the time it was treated and the end of the fiscal year was 4 units on October 17 and 15 units on November 21.

"The effect of the treatment on other organisms was not as pronounced as in the case of the anabaena, belonging to the

cyanophyceae, as will appear in the following table:

Microscopical Organisms in Antietam Water.

Numbers in Standard Units Per Cubic Centimeter.

	Average number during 3 months before treatment.	Average number during 3 months after treatment.	Average number during balance of fiscal year.
Diatoms	46	49	14
Chlorophyceae ...	21	86	5
Cyanophyceae ...	34	10	1
Protozoa	13	5	2
Rotifera	44	3	2

The cost of the two treatments was $42.77. The capacity of the reservoir is 101,000,000 gallons, and the average daily draft from it was 3,231,033 gallons, or a total for the year of 1,182,600,000 gallons.

Flood Water Channel and Reservoir Inlet.

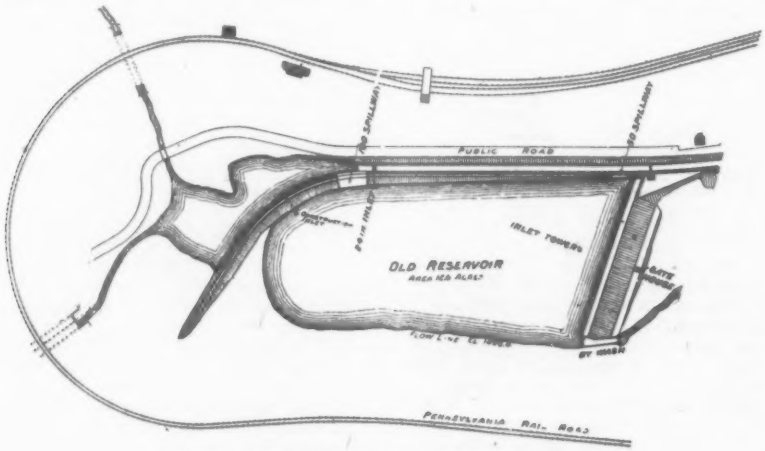
The accompanying drawings show the inlet from flood water channel to a new reservoir of the Altoona, Pa., water supply system which is now under construction just below the Kittanning Point reservoir from plans made by, and under the supervision of Knight and Hopkins, civil engineers, Rome, N. Y. This new reservoir is an extension of the works planned and constructed by the same engineers in 1894 to 1897 and described in a paper before the New England Water Works Association in 1899.

One of the accompanying drawings shows the old reservoir, built in 1887, and the flood water channel around it, built in 1897, and gives the general plan for all the reservoirs. The flood water channel was built to save the heavy annual expense of clearing the upper reservoir of the accumulations brought down the valleys tributary to the stream, consisting of driftwood, sawdust, coke cinder, sand and gravel. The amount of this deposit has been in excess of 20,000 cubic yards in one day.

The flood water channel construction includes the diverting embankment at the upper edge of the old reservoir, as shown in the drawing, and the flood water channel proper, extending along the north side of the old reservoir. A second reservoir of greater capacity lies immediately below that shown in the drawing, and the flood water channel as first constructed was carried the full length of this reservoir and discharged into the bed of the stream below. The new reservoir is located still farther down stream and the flood water channel will be carried around it.

In the drawing of the reservoir will be seen the location of the 24-inch pipe inlet from the flood water channel. It is similar in design to that shown in detail in the drawing of the inlet to the new reservoir, but differs slightly in dimensions. When the water in the stream is clear the valve in the inlet pipe is opened and the water runs into the reservoir. When it comes full of sediment and debris the valve is closed and the water runs down the flood water channel past all the reservoirs into the stream below. Except from sudden storms the water flows clear until the discharge is over 5,000,000 gallons a day, and this is made the capacity of the inlet.

The flood water channel is 20 feet wide at the bottom, side slopes 1 to 1, all paved with dimension stone, 8 feet deep and with a fall of 2 feet per 100. Just above the inlet shown in the drawing of the reservoir a 100-foot spillway is shown. This is intended to give relief to the flood water channel in case it should be clogged by debris at its throat. When the old reservoir is full the water passes its dam by a

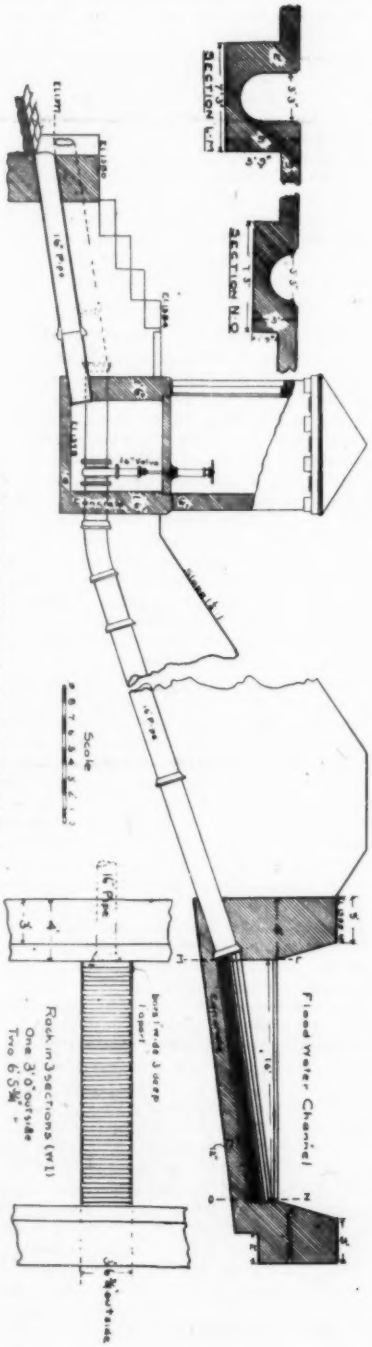


ALTOONA RESERVOIR AND FLOOD CHANNEL.

by-wash and a short length of the old stream bed into the second reservoir. There is an emergency spillway into the flood water channel, 50 feet wide, for use in case the flood through the reservoir is greater than the capacity of the by-wash channel.

When the second reservoir is full the excess of water flows over a spillway 25 feet wide into the flood water channel. Adjoining this spillway is an emergency spillway 100 feet long which comes into action when the capacity of the regular spillway, 50,000,000 gallons a day, is reached, the flood water channel being the only outlet of the second reservoir aside from the 24-inch pipe to the gate house of the city pipe lines and the 36-inch mud pipe.

The supply to the new reservoir is admitted from the flood water channel by the inlet shown in one of the accompanying drawings. The flood water channel at this point is 16 feet wide. In the bottom of the channel is an opening 3 feet 3 inches wide and 16 feet long, over which is a rack or screen made of wrought iron bars 1 inch thick on top and set 1 inch apart. These bars are 3 inches deep and ½ inch thick on the bottom, thus giving full opportunity for anything passing the upper surface to get through into the channel below. This channel is 2 feet deep at the outer end and 4 feet deep at the end nearest the reservoir, where it discharges through a 16-inch pipe into the new reservoir. On this pipe is a valve which can be closed when the water is turbid.



INLET TO RESERVOIR AT ALTOONA, PA.

It is interesting to note that the main channel lining and the channel for inlet to reservoir, constructed about ten years ago, were of stone masonry while those constructing this year are of concrete.

We are indebted to Knight and Hopkins for the drawings of the structures. The form of inlet used was successful enough in the earlier construction to warrant its adoption without change of any important details in the new construction. They say that "some sediment drops into the masonry chamber under the grating during storms when the valve on the outlet pipe of this inlet is closed, but you will note that the masonry and the inlet pipe both have a very great inclination, which renders them self-cleansing when the valve is opened."

Mr. S. A. Gailey, superintendent of the Altoona water works for many years, says: "We have very little trouble with this intake clogging up, as our watchman visits it once a day during high water and removes any accumulation from the grate."

In the paper above referred to Mr. Knight says that in 1894, before the construction of the flood water channel, the water ran over the embankment of the upper reservoirs once for about fifteen minutes, on account of the breakage of a gorge at the railroad culvert a short distance above and the sudden release of a large amount of backwater accumulated behind it. The flood water channel and the emergency spillways have been designed with reference to such observed occurrences and have proved themselves to

be ample. In fact, Mr. Gailey says: "This channel is built sufficient to carry off any flood volume that may come. Additional protection is afforded of a 100-foot spillway to allow the water to relieve itself into the reservoir in case of greater volume than the channel is able to carry, but we have not in the ten or twelve years in which it has been in use, had any occasion to use the 100-foot spillway, the channel itself carrying off all flood volumes that have occurred."

Cost of Operating Sand Filters.

The following figures for cost of operation of sand filters are taken from the annual report of the Reading, Pa., Water Commissioners:

The Egelman filters are two open sand beds each 40 by 55 feet, with a capacity of 250,000 gallons each per day.

The Antietam filters are three open sand beds, each 108 by 144 feet, with a capacity of 1,750,000 gallons each per day.

Ice removal from the Egelman filters required 3.5 hours labor in December, 3.5 hours in January, 32 hours in February, 28 hours in March, and cost $14.05. Ice removal from Antietam filters required 197.5 hours labor in February and 40.5 hours in March, and cost $59.39. All the beds required cleaning in February, but only one bed of each set in the other months except Egelman beds in March.

Both beds of the Egelman filters required scraping every month of the year except August, they were scraped twice in May, July, October and March, and one bed was scraped three times in July, making a total for the year of 34 beds scraped. Two of the Antietam beds were scraped in September and March, all three were scraped in April, October, December, January and February, and beds were scraped more than once in the other months, up to a total of 4 beds scraped in July and November, 5 in August and 8 in each of May and June. This makes a total of 48 beds scraped during the year, or on the average each bed was scraped about once in 40 days. Water analyses cost $41.10 for Egelman and $37.38 at Antietam. Care of grounds cost $45.25 at Engelman and $513.86 at Antietam.

The amount of work done on and by the filters and the cost are summarized as follows:

	Egelman Filters.	Antietam Filters.
Gallons of water filtered per day	217,992	3,231,033
Gallons per acre per day	2,260,888	3,043,765
Gallons filtered between scrapings	4,693,234	73,909,870
Gallons per acre between scrapings	48,675,541	69,626,123
Gallons filtered during year	79,784,976	1,182,557,923
Cubic yards of ice removed	147	835
Cost of removal per cubic yard	$0.10	$0.07
Cubnc yards of sand removed	122	1818
Cost of removal per cubic yard	$0.69	$0.48
Cubic yards of sand washed	.....	1831
Cost of washing per cubic yard	.....	$0.60
Cubic yards of sand refilled	.....	1921
Cost of refilling per cubic yard	.....	$0.51
Total cost of filtering per million gallons including all expenditures	$3.57	$3.31
Cost of filtering, excluding analyses and care of grounds	$2.61	$2.84

The Egelman filters did not exceed a monthly average of 10 bacteria per cc. in the filtered water, the bacterial efficiency varying from 93.9 in June to 99.8 in September and February and averaging 99.3 for the year. The Antietam filters showed monthly averages of 9.9 in August to 786.0 in February of bacteria in the filtered water, the bacterial efficiency varying from 66.2 in April to 98.7 in November and averaging 91.6 for the year.

Turbidity, measured by silica standard, was all removed by the Egelman filters and also by the Antieam filters excepting February, when 98.7 per cent. was removed.

The Antietam filters supply about 26 per cent. of the consumption of the city and the Egelman filters about 2 per cent. There are four other sources of supply.

Cost of Repairing Asphalt Pavements.

The number of municipal asphalt repair plants is increasing gradually and a few of them have now been in use long enough to give some idea of the cost of operating them so that at least a preliminary comparison can be made with the contract system still in use in most cities. Such plants as those at Columbus, O., and Indianapolis, Ind., have not been in operation long enough to give more than a daily force and material account and the actual effect of idle time, accidents, depreciation, repairs, etc., cannot be given exactly. The figures from them will be given more fully when more reliable statements can be made.

Under the contract system in some cities the price bid is per square yard of pavement replaced. The prices vary greatly, being $1.65 in Minneapolis and St. Paul; $1.50 in Utica, N. Y.; about $1.35 in Indianapolis in 1906; $1.35 to $1.50 in Columbus, O., $1.75 in 1897 in Rochester, N. Y., reducing gradually each year to $1.27 in recent years; $1.23 to 74 cents in Buffalo, N. Y.; 89 cents in Toronto, Ont.; 66 cents in Indianapolis in 1907. The last named contract was the cause of much scandal on account of an alleged attempt to make up for the low price by over-measurements of areas of work done.

Other contracts are per cubic foot of

material placed, measurements being taken at the plant as the wagons are loaded. Under the contract system Brooklyn, N. Y., paid in 1905 67 cents per cubic foot for wearing surface and 25 cents per cubic foot for binder. Washington, D. C., paid 49 and 25 cents respectively. A compression of one-sixth in laying makes the cost of the asphalt wearing surface in place in the pavement 78 cents per cubic foot in Brooklyn and 57 cents in Washington.

The cost of laying asphalt in repairs by the Brooklyn municipal asphalt repair plant, which went into operation in June, 1907, has been 85.19 cents per cubic foot of wearing surface and 74.46 cents per cubic foot of binder. These figures include materials, labor, transportation, supervision, fixed charges, maintenance and operation of plant machinery and tools. If the thickness of the wearing surface is assumed at 2 inches, as in New Orleans, the cost of wearing surface per square yard becomes $1.28.

It is not easy to reduce the reported costs of running the New Orleans municipal asphalt repair plant to the same basis as the figures given above on account of numerous differences in conditions, for example, absence of binder and greater thickness of wearing surface. The plant was used for laying new asphalt pavements as well as for repairing old pavements. Material and labor costs were kept separately, special charges against the asphalt plant as a whole were divided equally between the new and repair work and general charges against the paving and repair department were divided among the three sections, new, repair and miscellaneous work, 35 per cent. going to the repair section. The "naphtha coat" was laid under about two-thirds the asphalt wearing surface deposited, and new concrete was put under about one-eighth of it. Deducting the cost of the concrete at 87 cents a square yard, the figure derived from the data regarding the work, the remainder will give the combined cost of Naphtha coat and wearing surface for all the repairs made. This cost averages $1.03 a square yard, and does not include depreciation and interest on cost of plant, which may amount to 15 cents a square yard, making a total of $1.18. It is quite possible that this figure is too high, for new pavements, deducting cost of grading and concrete foundations, seem to have cost only 63 cents a square yard for the naphtha coat and asphalt wearing surface, as compared with $1.03 above. Repair work is more expensive than new work, but this difference of 40 cents seems to be excessive and may be due to errors in either or both items made in the rather complicated distribution of costs.

The first season of the Columbus, O., repair plant has not yet ended, but the operators of the plant have been obliged to fix a price for work done for other persons than the city and have set $1.25 a square yard as a price for such work, which, including all general and special items, plant and fixed charges, as well as maintenance and operation, will cover the actual cost with as little margin as is safe in the absence of full data.

Various reports from the Detroit, Mich., plant have shown 83.6 cents per square yard cost of materials and labor and $1.05 including all items of cost.

In Allegheny, Pa., one report shows 75 cents a square yard as the cost of asphalt repairs for material and labor.

An unofficial report from Dayton, O., indicates a cost of 57 cents a square yard, which probably includes only materials and labor.

The average cost in the Montreal municipal asphalt plant is $1.22 a square yard, including all work in connection with the repair.

The Winnipeg municipal asphalt plant keeps detailed records of the work done. Records of laying of new pavements are at hand. Deducting from the total cost for new pavements the cost of grading, sand foundation, concrete and binder, and 40 per cent. of the general charges, leaves the cost of laying the wearing surface 87 cents per square yard. This is doubtless somewhat less than the cost of laying the same area of repair work.

Allowing for the difference in conditions in these various cities it is fair to fix on about 85 to 90 cents per square yard as the average cost of laying repair work for materials and labor, and say $1.15 to $1.25 including all charges in municipal plants. Cost of the various materials and of labor and the weather conditions produce variations each way from these averages.

Cities letting their asphalt repairs by contract have considered prices fair when they range from $1.25 to $1.50 according to locality. The difference indicates the cash saving to the street repair departments.

Several cities have installed plants for doing their own asphalt repair work, not so much because they expected a reduction in the cost of the work, as for the purpose of securing complete control of the kinds and qualities of materials to be used and time of making repairs. In these respects the cities have found the results very satisfactory, enough so to warrant some increase in cost. However, as the above figures will show, a reduction in cost has also resulted in nearly every case.

Contractors for asphalt work express themselves frequently as being greatly pleased with the results from the municipal asphalt repair plants. They are usually able to induce the municipal plant to do repair work and small jobs at a reasonable price, which, while greater than the cost to them if their plant is running, saves them much expense if the plant must be started up for a small amount of work or particularly if a plant must be moved in from some other city. The city's street

repair department is more than satisfied because it has complete control of the materials and workmanship and can thus insure good work done at the right time.

Distribution of Sizes of Water Pipe and Cost in Providence, R. I.

The city of Providence, R. I., has an estimated population of 208,000, covers an area of 16.2 miles of land, has 237.67 miles of received streets and 144.85 miles of platted streets not yet received, or a total of 382.52 miles, of which about 36 miles have been paved and nearly 200 have been otherwise improved, largely with gravel or macadam.

That the city is well supplied with water mains is shown by the statement that there are 366.6 miles of water mains in the system, of which 305.7 miles are within the city, 49.7 miles are distribution pipes in surrounding towns, and 11.2 miles are force and leading mains outside the city.

The following table shows the mileage of each size of pipe, the percentage of each size and the estimated cost of laying each size of pipe laid during 1907, including appurtenances except hydrants, and counting iron at $35 a ton.

Water Pipe System of Providence, R. I.

Sizes of Pipes in inches.	Length in Miles.	Percentage of Total.	Cost of Laying per foot in 1907.
42	4.86	1.33	.....
36	1.93	0.53	$9.683
30	11.63	3.19	7.195
24	8.75	2.40	5.052
20	1.82	0.50	3.817
16	8.47	2.32	2.730
12	22.01	6.01	1.809
10	2.77	0.76	1.408
8	59.76	16.31	1.098
6	244.61	66.65	0.815
Totals	366.61	100.00	

These data are taken or derived from the reports of Otis F. Clapp, City Engineer.

Concrete Street Paving.

The first concrete street paving has been laid in Allentown, Pa., and is located on Allen street, between Fifth and Sixth, along the properties of T. F. Heaney, Joseph H. Koehler and Wm. E. Erdell, 138 feet long by 36 feet wide. It was put down July 13, 14 and 15, 1908, three days' work with twenty men, by the Lehigh Granolithic Street Paving Co., of Allentown, Pa., J. A. Schaeffer, manager.

The street was excavated to a depth of 5 inches and then rolled with a six-ton roller, which compacted the earth 1 inch. A 5-inch base of concrete was put down, consisting of one part Portland cement and seven parts crushed stone, hand-mixed and thoroughly tamped. The mixture was fairly wet and tamping continued until the water flushed to the top. The 1-inch topping or wearing surface was put on in from one to six hours after the base was put down, and consisted of one part of cement and two parts of ground granite, of a fineness passing through a one-quarter-inch screen. The topping was also hand-mixed and quite wet. It was graded to the proper pitch of the street and the surface floated. As this would have left the surface too smooth, it was roughened after being put down by means of a coarse reed brush.

The expansion was taken care of by a three-quarter-inch expansion joint on both sides of the street against the curb. The joint was made by placing a three-quarter-inch surfaced board against the curb and the concrete deposited against the board. The board was removed before the concrete had set. After the concrete had set, the joint was filled with 4 inches of sand and 2 inches of pitch on top. One expansion joint was put crossways in the street at one-half the distance, or 79 feet from either end. This was made in the same way as the joint along the curb.

Particular attention was paid to joining one day's work with previous days. The lower base was joined with a mixture of cement mortar, proportions being one of cement to two of sand. The topping was stopped each night with a vertical joint. The joints were so perfectly made that one cannot tell where they are.

Late in the afternoon of the second day a heavy rain came before the topping was set; in fact, some of the topping had just been placed. The rain roughened the concrete perfectly and the top dressing was allowed to stand as left after the shower.

The street was wetted down daily, and no traffic allowed for one week.

The cost of the work was $1.40 per square yard.

Permission to lay this paving was granted by the city council under the supervision of the city engineer. Mr. Erdell was instrumental in having the pavement placed, in order to demonstrate the value of concrete paving for highways.—*Concrete Review.*

Pottery Clay at Hot Springs, Ark.

Noticing some time since, in one of your publications, that communications from your subscribers or others relative to the natural resources and development thereof in any portion of our country, tending to wider general information for the benefit of the manufacturing industries, would be welcome, I have taken the liberty of sending you this communication, which, if you deem of sufficient importance, you are at liberty to publish.

There is located within the radius of eight miles from this city a body of clay, 9,000 feet long, 2,500 feet wide and 400 feet above the level of the surrounding

country, and estimated to contain 400,000,000 tons of clay. This deposit of clay is characterized as a true mineral lode or vein, and is protected on each side by hanging walls of stone from 4 to 6 feet thick, presenting very smooth and straight surfaces. An excavation has been made at the foot of the mountain on the south end of the vein and extending in 100 feet, showing the clay to be uniform and free from any foreign substances that would require washing or any process of separating. No effort has been made to determine the depth of this vein below the surrounding surface.

While the country in the vicinity of Hot Springs is comparatively worthless for agricultural purposes, an All-wise Providence has more than offset this deficiency by giving to us and the world the wonderful hot springs for the cure of so many diseases not benefited elsewhere, and now, at the foothills of the Ozarks and at our very doors, lies nature's laboratory, wherein is prepared this wonderful clay, ready for the potter's use without the addition of any other ingredient except water, combining all the essentials necessary for the manufacture of art goods, table or sanitary ware. It is only recently that the full value and various uses to which this clay can be put have been determined.

The manufacture of pottery is recognized as one of the leading industries of the world, and it constitutes a most important branch of training in the industrial and art schools of the country.

This clay, when first taken out of the mine, is about the consistency of putty, pliable, easily manipulated, and closely resembling it in color. Upon drying, it is perfectly white, brittle, and a specimen of it might, to the untrained eye, be easily mistaken for chalk, and will, without admixture of any other elements except water, make the finest art ware, vitreous ware of all kinds, tiling, glazed, pressed or ordinary brick, at one burning and with 50 to 300 degrees less heat than other clays require, and at an estimated saving in cost of manufacture approximating 35 to 50 per cent.

Its superiority over ordinary clay has been amply demonstrated by experts and practical men. By ordinary methods of manufacture other clays often are mixed with other ingredients coming from various parts of the world, such mixtures often being trade secrets, and require many hours of preparation and much expert handling. This Hot Springs clay is already mixed and ground by nature, and requires only addition of water in the blunger, and in two hours is ready for the mold.

The saving is estimated at six hours of time, the wear and tear on expensive machinery, high-priced supervision and an equal amount of time in casting and one burning in the kiln.

A small demonstrating plant is now in operation in this city to show just what this clay will do, and many visitors declare the art ware made is equal and even superior to similar well-known goods made elsewhere.

An analysis of this clay, made by E. C. Eckel, U. S. Geologist, Washington, D. C., is as follows:

	A	B	C
Silica	74.55	72.06	74.90
Alumina	13.68	15.31	15.35
Titanic Oxide	.73	.95	....
Iron Oxide	1.27	1.24	1.77
Lime	.20	.17	....
Magnesia	2.03	2.26	0.83
Soda	.10	.17(	
Potash	3.84	4.53(	3.79
Combined Water	3.63	3.50	....
Moisture	.77	.48	....
Loss on Ignition	...	....	3.79

Sample B is taken 3,000 feet west of A in this mine. See Bulletin No. 285, Series A, Economic Geology, 73, page 409, United States Geological Survey. C is an analysis made by the Laclede Fire Brick Co.

Mr. C. W. Parmelee, director of the New Jersey School of Clay Working and Ceramics, New Jersey State College, New Brunswick, N. J., says: "This clay was used alone, without mixture of any kind of material. Amount of water to bring it into workable condition, 33 per cent.; shrinkage on air drying, 5 per cent.; tensile strength, 47 pounds per square inch. Burned at cone .01 (2066 degrees F.), it gives a porous biscuit of a light buff color. Sample pieces made by dry process and burned at this temperature gave a fire shrinkage of 2½ per cent. Burned at cone 8 (2354 degrees F.), the clay gives a vitrified body, showing it to be a stoneware clay. The clay can be successfully glazed, as shown by numerous tests made by myself. This clay is suitable for the manufacture of stoneware, sewer pipe and similar vitrified work or ware, for art wares or wares for household use,, for front brick, glazed and enameled brick."

It has developed recently that the clay has valuable medicinal qualities on account of its absorbent qualities in the reduction of inflammation, in cleansing eruptions. Several prominent physicians here are using it in lieu of antiphlogistine. This clay is in demand and is being shipped in carload lots to Memphis, Tenn., Oklahoma City and other points, for use in making mud baths.

GEO. M. FRENCH,
Civil Engineer, Hot Springs, Ark.

Mr. French gives also extracts from commendatory letters written by users of the clay for pottery and paint.

Waterproofing Concrete Pipe.

Mr. F. P. Van Hook. Boise. Idaho, is at work upon the construction of a reinforced concrete siphon 50 inches in diameter, with 64 feet head on the lowest point and 48 feet fall in the 5,700 feet of length. Mr. Van Hook is waterproofing the concrete first by using in the concrete 5 to 7 per cent. of the mixture used for making

sand-lime brick. 1 part lime and 2 parts ground silica, and, second, by using a wash made of 1 part hydrated lime, 2 parts ground silica and 1 part Portland cement. The first coat is applied with a good stiff brush and a second coat of the same material is applied immediately, using less water, making a good stiff paint. He considers this the best waterproofing he has found in his experience. The siphon will carry water to irrigate 2,000 acres of land.

Much cement is being used in irrigation projects in this vicinity. The Snake river project will take about 85,000 barrels, the Salmon river 65,000, the North Side project 50,000, and still another project 35,000 barrels.

ROADS AND WATER

Bithulithic in Oregon—State Roads in Washington—Cost of Fire Protection—Water Power Valuation

Bitulithic Pavement in Portland, Ore.

The city of Spokane, Wash., which has under consideration the construction of bitulithic pavements, is in receipt of a letter from D. W. Taylor, city engineer of Portland, Wash., regarding that city's five years' experience with bitulithic, which is as follows:

The first bitulithic pavement laid in this city was completed in November, 1903. This was on a roadway 36 feet wide and about 600 feet long. Additional paving was laid at the same time under a private contract on adjoining streets. Four streets were put down in 1904. Five streets were put down in 1905. Six streets were put down in 1906. Nineteen streets were put down in 1907.

At the end of 1907 there were in existence 9.8 miles of this pavement. On September 1, 1907, there had been laid in Portland a total of 183,377 square yards of bitulithic. During 1908 some 12 or 13 streets have been improved with this pavement, making a total of 248,769 square yards now in use in this city.

In addition to this there are 14 streets now under improvement embracing 70,308 square yards. There are also quite a number of streets proposed to be improved with this pavement for which estimates are now being prepared.

This pavement is made by first grading to proper subgrade and thoroughly rolling the same, then covering the surface with crushed rock of proper size, so that the same shall be four inches thick after rolling with the 10-ton roller. A sufficient amount of asphalt cement is then spread over the rock to thoroughly bind the surface. On this is placed two inches of wearing surface made with clean crushed rock of varying sizes, sand or stone dust and asphalt cement. When rolled the surface is covered with a thin coating of asphalt cement and a layer of stone chips spread over the roadway.

Along the curbs the drains are placed under the pavement and connected with the sewers. Where there are street car tracks the space occupied by each track and one foot outside the rails is improved with stone blocks on a concrete foundation, the joints being grouted with Portland cement mortar or asphalt cement.

Pavements as a rule appear to be wearing well, are not as slippery as asphalt, owing to having a rougher surface, but this becomes smoother with travel.

The contractors agree to keep the pavement in good repair for 10 years.

For this they receive annually from the city repair fund 2½ cents for each square yard of pavement on the streets.

The oldest pavement in this city has only been down a little over four and one-half years so that it is hard to determine just what is the life of the pavement. The pavement so far is giving good satisfaction and is well liked.

On one street put down in 1904, where the travel is quite heavy, considerable repairs have been made. The contractors claim that the trouble on this street was caused by the man in charge of the plant at that time allowing the material to become overheated. I think this statement is probably true, judging by the good condition of adjoining bitulithic streets. There is also another street subjected to heavy travel, laid last year, which has required some repairs from time to time.

The foundation of this street was badly cut up just before the pavement was laid, in order to put down a larger water main on one side and a large gas main on the other, besides numerous cross trenches connecting with these mains.

As the foundation course of a bitulithic pavement is crushed rock, it is very necessary that the subgrade should be firm and hard, and thoroughly rolled to prevent settling.

There are about 10 streets improved

with bitulithic in the business portion on the west side of the river and four on the east side. On several others that are classed as residence streets, one end of the pavement extends into the business section.

Previous to this year the price for this class of pavement was $2 per square yard, exclusive of the cost of curbing, grading and tile drains. The grading varied according to the amount and character of material to be removed, but where the streets had previously been improved with some other kind of paving the grading would cost from 10 to 15 cents per square yard. The tile drains cost 12 cents per lineal foot, artificial stone curbs 40 cents per lineal foot and artificial stone sidewalks 12 cents per square foot.

This year the price of the pavement itself has been advanced from $2.15 to $2.20 and that price is slightly increased where the material has to be hauled over one mile.

State and State-Aid Roads in Washington.

A recent statement showing the progress made in building roads in the State of Washington under the laws enacted by the legislature of 1905 and 1907 is as follows:

Two classes of roads have been constructed under these laws, state roads and state-aid roads. State roads, during 1905 and 1906, were built jointly by the state and the various counties through which they passed, the state paying two-thirds of the cost from the general fund and the county paying one-third of the cost. During the years of 1907 and 1908, this class of roads have been built entirely at the expense of the state, the cost being paid from the public highway fund.

The second class of roads, known as state-aid roads, have been built jointly by the state and the various counties in which tney are located, each paying one-half of the cost.

The state roads built have been, with few exceptions, well finished earth roads of from twelve to eighteen feet in width, while the state-aid roads have generally been of macadam or gravel, finished in a thorough manner: though in some instances earth construction has been resorted to in the case of entirely new roads in order that a proper settlement of embankments should take place before proceeding to finish them with macadam or gravel.

Extra Cost of Water System to Furnish Fire Protection.

The U. S. Geological Survey is making a study of the additional cost of water supplies needed for fire protection beyond what is necessary for domestic uses, and has sent out the following list of questions with request that they be answered and the answers sent to H. M. Wilson, chief engineer of the technologic branch, Washington, D. C. The information received will be treated as strictly confidential, only total figures, combined with those of other cities, being made public.

1. Name of city.....State.....
2. Population.....Year, 19.....
3. (a) Total estimated cost of distributing system. $.....
   (b) Number of feet of various sizes of pipe in distributing system or tons of metal in same.....
   (c) Estimated cost of distributing system if necessity for fire service were omitted and only domestic supply required. $.....
   (d) Weight of metal under same conditions. .....tons.
4. (a) Total estimated cost of water supply, by pumping or reservoirs and gravity flow, for above distributing system. $.....
   (b) Estimated cost for domestic requirements only (see 3 c). $..
5. (a) Total number of fire hydrants in your system (3 a). .....
   (b) How many could be dispensed with? (See 3 c.) .....
6. If you have or contemplate a separate high-pressure fire system, what is its estimated value? $.....

The above data may, if you prefer, be given on the basis of cost per capita for each item.

This subject was treated generally in an article on "Water Rates and Rentals," in MUNICIPAL ENGINEERING, vol. XXXV, p. 73, in which references to previous articles giving more detailed studies of the question will be found.

Valuations of Water Powers.

A committee of the New England Water Works Association, appointed "to collect data relating to awards that have been made for damages resulting from the diversion of water; also to consider the practicability of joint action with the National Cotton Manufacturers' Association, or other organizations of mill owners, relating to the formation of standard rules for computing or assessing damages for the diversion of water," is asking engineers to send to its secretary, Leonard Metcalf, 14 Beacon street, Boston, Mass., names of the instances of which they have definite knowledge and specific information which they are willing to give to the committee, in which valuations or sales have been made of, or judicial awards have been handed down for water or water power diverted for any public or corporate uses, together with a memorandum of the names of the principal experts who have given testimony relating to these cases, from whom specific data might be obtained.

From the preliminary information obtained in response to this circular letter the committee will be in a position to send out schedules to those who have such information and are willing to publish it, from which may be prepared the general report upon this subject which the committee hopes to make to the association.

MUNICIPAL AND TECHNICAL LITERATURE

Municipal Reports.

Annual Report of the Lowell, Mass., Water Board, 1907. Geo. Bowers, City Engineer.

When new territory was acquired by Lowell the water board was given $58,000 to supply it with a system of water pipes and has laid 15,308 feet of mains of 1½ to 12 inch diameter, and 7,748 feet of pipe in 205 services, with 65 hydrants and 67 gates, thus serving the whole district. The cost of the work was $55,723.78, or $3.64 per foot of main. Much of the work was expensive on account of work in excavation.

The question of charge for meter on fire protection services of factories was settled in favor of the charge by the city for all water used through such fire service connections, except that used for fire extinction, the meter to be paid for by the consumer.

Bids were received for a new pump, the contract going to the Holly Mfg. Co. at $26,900, which was $7,200 higher than the same company bid for the same pump in 1905. There was a similar difference in other bids received on the two dates.

The regular meter rate is 14 cents per 100 cubic feet or $168 a million gallons. The amount actually received for water sold averaged $99.45 a million gallons. The difference is due to water furnished the park department, public drinking fountains, flushing sewers and puddling sewer trenches, low rate on water for street sprinkling and unmetered water wasted and not accounted for. The city departments paid the water department $5,507.95 for water used, besides $1,500 for street sprinkling at a rate one-third the regular rate. The cost of pumping water was $20.64 per million gallons, the cost of maintenance was $62.28 and the total cost including interest was $85.20. This leaves some $14 per million gallons for sinking fund or extensions.

The standard summary of statistics is used in the report. The percentage of services metered is 73.6 and the percentage of receipts from metered water is 84.8.

Report of the Board of Water Commissioners of Reading, Pa., for year ending April, 1908. Emil L. Nuebling, Superintendent and Engineer.

The value of the water works is $3,060,934 on which the debt is only $280,806. The filters are supplying water of satisfactory quality and $500,000 has been appropriated to filter the supplies not already purified.

The cost of supplying water, including maintenance and general maintenance, which includes state tax and interest on debt, is $16.68 per million gallons. An interesting table gives the cost of maintenance of each supply, the proportion of the general maintenance charge applicable to each supply, the total cost for each supply and the cost per million gallons for each supply. The latter varies from $11 per million gallons for Hampden Springs, which furnishes to reservoir by gravity only 0.85 per cent. of the total consumption and cost nothing for individual maintenance, to $31 for Egelman supply, which furnishes nearly 2 per cent. of the consumption by gravity to reservoir and has two open sand filters. Sand was not washed and filters were not refilled during the year, so that the maintenance charge for this supply was not as large as usual.

Maiden Creek furnishes half the supply by pumping without filtration at a cost of $18 a million gallons.

The cost of maintaining the 2,012 meters in service was $1.77 per meter per year, 2 cents more than the previous year. Receipts during the year were $230,066.71 and expenditures were $79,753.36 for maintainance, interest and transfer to park department and $136,171.40 for construction. The city pays nothing for water for public uses. Counting 933 fire hydrants at $25 each, the estimated value of the free water furnished is $28,021.07.

The standard form of summary of statistics is used. The department should be highly commended for the detail and apparent accuracy of the classification and separation of accounts.

Annual Report of the City Engineer of Cambridge, Mass., 1907. L. M. Hastings, City Engineer.

Two new bridges were completed during the year of the report, one over a railroad, costing $13,720, and one a rolling lift bridge over a canal, costing $18,839. New paving, 2.1 miles in length was laid during the year, the cost or character of which is not given in the report. New sewers costing $57,753 and over 10,600 feet long were built during the year.

The standard summary of sewerage statistics is used. Catch basins to the number of 1,948 were cleaned during the year, the average amount removed from each basin being 2.41 loads, which seems to be equivalent to 1.8 cubic yards, the cost of removal being $2.54 per basin per year, or $1.41 a cubic yard.

A system of accounts whereby the report of some city official would show the

cost of all classes of work in detail is desirable in Cambridge for the benefit of the taxpayers as well as of those elsewhere who are seeking information about the city's activities.

Annual Report of the Water Works Division, Board of Public Service, Cleveland, O., for 1907. Edward W. Bemis, Superintendent of Waterworks.

Mr. Bemis opens his report with a proof of the good quality of Cleveland water drawn from the comparative typhoid fever death rates of the 42 largest cities in the United States. He derives the rates from the reported deaths from typhoid fever in these cities and their populations for 1907 as estimated by the U. S. Census Bureau. The cities with typhoid fever death rates less than 10 per 100,000 of population, according to Mr. Bemis's collection of data, are in order: Boston, Mass., with 4; Providence, R. I., Fall River, Mass., St. Joseph, Mo., and Paterson. N. J., with 9.6. Cleveland has 17.6. The cities with typhoid death rate more than 40 are in order: Baltimore, Md., with 41. Richmond, Va., Cincinnati, O., New Orleans, La., Denver, Colo., Philadelphia, Pa., Louisville, Ky., Scranton, Pa., Nashville, Tenn., Atlanta, Ga., distributed along the way to 80, Allegheny, Pa., with 91, and Pittsburg, Pa., with 131.5. Only 12 cities have a lower typhoid rate than Cleveland, while 29 have a higher rate.

The use of meters is increasing, 89 per cent. of the services being metered and nearly 69 per cent. of the consumption being paid for by measurement. About 80 per cent. of the water is accounted for by measurement and estimate, leaving about 20 per cent. loss by leakage and other undiscovered waste.

The water department makes a profit after all operating expenses, interest on bonds, a small sinking fund charge and depreciation, leaving in 1907 $160,000 for new construction. This is in spite of the fact that the department furnishes free water for fire protection to over 8,000 hydrants, a service worth over $240,000 a year, and about $74,000 worth of free water for public and charitable institutions and services.

The standard form of summary of statistics is used.

The accounting department is revising its forms and expects soon to be able to supply any reasonable detail of information about the operation of the system and the financial results thereof.

The report of the mechanical engineer contains full data of tests of two new pumping engines and of tests of sample coals under the pumping station boilers. It also gives the details of the results of a large number of observations on the electrical conditions of the water pipe system, showing by map the areas found to be injuriously affected. The meter department also gives a full report of its operations and details of cost which is worthy of careful study.

The report would lose many pages without serious detriment to its value if summaries of work in the pipe-laying department were given and the details of individual lines, valves and hydrants were left on file in the office.

Report of the Board of Park and Cemetery Commissioners of Saginaw, Mich., July 1, 1905, to January 1, 1908. R. W. Roberts, Engineer.

In this booklet the first board of park commissioners includes its reports of work done during its period of existence. Saginaw is fortunate in having a number of public-spirited citizens who have perpetuated thir memories by donating park lands to the city. Hoyt, Bliss, Rust and Jeffers parks, of 27, 13.3, 116.2 and 0.2 acres area respectively, are reminders of the men whose names they bear, and Linton Park, 16 acres, donated by several citizens, bears the name of a respected former resident of the city. Merrill and Webber parks of 9.7 and 9.5 acres area were set aside on plats of the Saginaw Improvement Co. for park purposes. There are seven other small triangles, irregular areas or grounds of railroads, U. S. government or others which are maintained by the park board, in addition to Riverside park, 80 acres, owned by a street railroad company.

The city is, for its size, quite well supplied with small and medium sized parks, and the efforts of the park board, during its short life thus far, have begun to show the uses which can be made of them as beauty spots and as recreation grounds for men, women and children. Several photographs are reproduced to show conditions when the board began its work and at the present time, and the expense account shows that the marked improvement shown has been secured at very low cost. A part of Mr. Bliss's gift to the city was $20,000, the interest on which is to be used in maintaining Bliss park, which was in addition to other gifts of $6,000 or more to begin the improvement. The example of Saginaw's citizens may well be followed in other cities.

Annual Report of the City Engineer of Portland, Oregon, 1907. D. W. Taylor, City Engineer.

The record of street improvement done in 1907 shows 149 streets improved, 24 with gravel, 40 with macadam, 4 with plank roadway, 5 with new stone block, 1 with stone block redressed and relaid, 19 with bitulithic aggregating 68,690 square yards, 2 with asphalt, 5 with concrete, 85 with artificial stone sidewalks, aggregating 612,966 square feet. There were also wooden and gravel sidewalks, artificial stone and wood curbs and cross walks on many streets. The total cost of the work was $897,485, nearly $200,000 of which was for bitulithic, the material of almost all the permanent pavements laid. The mileage of improved streets now includes 8.6 miles asphalt, 5.3 stone blocks, 1.9

wood blocks, 13.0 bitulithic, 72.5 macadam, 92.3 gravel, 7.4 plank. 1.2 brick.

Sewer work included 83,048 feet of sewers, all but 1,700 feet being of pipe. The cost of the sewer work of the year, including all appurtenances, was $92,781. The sewer system now includes 884,561 feet and the sewers range in size from 99x66 inches to 6 inches. The only sizes having more than about one mile of length are the pipe sewers of 8 to 24 inches diameter. Sixty per cent. of the sewers are of 8, 10 and 12 inch pipe.

The city has 250 miles of artificial stone sidewalks, 206 miles of wood and 10 miles of gravel.

Salaries of office men, surveying parties and inspectors under the city engineer amounted to $43,453. The total expenditures of the department, payable from the general fund, include sewer repairs and add $41,000 to the above. The city engineer also looks after street repairs, which, for survey party, clerk and inspectors, cost $12,000, and for materials and labor of the repairs to streets, bridges, sidewalks, cross walks and gutters, cost $72,000, of which only $4,500 was for repairing hard surface pavements.

Annual Report of the City Engineer of Providence, R. I., 1907. Otis F. Clapp, City Engineer.

The city engineer's office of Providence is administered very economically, the cost for general work being $42,012, over $39,000 of which is for salaries, and the engineering work in maintenance of waterworks being $11,334 additional. Over five miles of new water pipe were laid, nearly two of which were to replace old pipes. There was added to the high pressure system another 2.9 miles of 12- and 16-inch pipe. The net cost of maintenance for the year was $206,000 and the receipts were $741,000. The total revenue for water sold during the 38 years existence of the works is practically double the total cost of the works. The standard form of water works summary is used except that the annual financial statement is omitted. The average efficiency of the water filters for the year was 98 per cent, the minimum being 93.1 in February. The average rate of filtration varied from 1,586,000 gallons per acre per day on bed No. 8, in use 1,447 hours, to 2,482,000 on bed No. 3, in use 7,761 hours. An average of 35 per cent. of the color was removed.

The sewers were extended 3 miles, making the total 180.7 miles as compared with 366.6 miles of water mains and 8.5 miles of high pressure mains.

Comparatively little paving was done, 36,971 square yards in all, nearly two-thirds of which was bitulithic, the remainder being short streets in granite blocks, with one small area of asphalt and one still smaller of stone.

No details of cost of improvements are given except tables showing the approximate "cost per linear foot" for laying water pipe and sewers.

ORGANIZATIONS AND INDIVIDUALS

American Society of Municipal Improvement — League of American Municipalities—Technical Meetings—Civil Service—Lectures on Electricity—Personal Notes

American Society of Municipal Improvement.

Request for advance information regarding the program of the Atlantic City convention to be held October 20 to 23 has met with no response from the officers in charge of the society this year and the official program is delayed until after this number of MUNICIPAL ENGINEERING is printed, so that the only information available is the place and date, as above, the place of meeting and headquarters at the Hotel Dennis, whose rates are from $3 to $7 a day, American plan. If 100 members pay full fare to Atlantic City a reduced return fare of three-fifths can be secured for the return ticket. Each purchaser of ticket going must secure the regular certificate. This concession is announced only for the Trunk Line Association territory, which extends west to Buffalo and Pittsburg.

The executive committee will meet Tuesday morning, October 20. The address of welcome will be given in the afternoon by Mayor Franklin P. Stoy. The business of the association will occupy Tuesday evening, Wednesday morning and evening, Thursday morning and Friday morning. Wednesday afternoon will be devoted to a drive about the city as the guests of the Publicity Bureau and the hotel and business men of the city. There will be a re-

ception Thursday evening by city officials and leading citizens at the hotel headquarters.

Those desiring further information are requested to write to the editor of MUNICIPAL ENGINEERING, and it will be forwarded as soon as it is received.

Among the papers to be presented are one by Isaac R. Breen, the city attorney of Watertown, N. Y., on the subject, "A Municipal Franchise Is a Valuable Asset and Should Be Treated as Such by Municipal Officials," and the report of the committee on municipal franchises and a paper on "A Modern Municipal Franchise," by Charles Carroll Brown, the chairman of the committee.

The League of American Municipalities.

The twelfth convention of the League of American Municipalities is in session in Omaha after this number of MUNICIPAL ENGINEERING is in the mail, so that no account of it can be given at this time. The program announced contains a number of excellent papers, such as the following: "Bureaus of Municipal Information as Educators," by Jas. F. Connelly, of the Newark, N. J., bureau; "Present Status of Sewage Disposal in America," by Prof. A. Marston, Ames, Ia.; "How Detroit Handles Paving Contracts, Cleans Its Streets and Controls Its Street Railways, Light and Water," by E. R. Schreiter, Detroit, Mich.; "Uniform Accounts and Reports for Cities," by L. G. Powers, chief statistician, U. S. Census Bureau. The latter subject is discussed also by Frederick A. Cleveland, technical director of the bureau of municipal research of New York City; H. F. Hooper, comptroller of Baltimore, Md., and James G. Reddick, mayor of Norfolk, Va.

Home rule for cities is the subject for one session, municipal government by commission for another, and the liquor problem in the cities for a third, each with a list of well-informed and interesting speakers. John MacVicar, the secretary, is now the superintendent of the department of streets and public improvements in Des Moines, Ia., under the new charter of that city, which embodies the commission plan.

Technical Meetings.

The annual convention of the League of American Municipalities is held at Omaha, Neb., September 30, October 1 and 2. John MacVicar, secretary, Des Moines, Ia.

The annual convention of the Illuminating Engineering Society will be held at Philadelphia October 6 and 7. Van Rensselaer Lansingh, secretary, Engineering Societies Bldg., 33 W. 39th street, New York City.

The annual convention of the American Street and Interurban Railway Association will be held at Atlantic City, N. J., October 12, 13, 14, 15 and 16. B. V. Swenson, secretary, 29 W. 39th street, New York City.

The annual convention of the American Society of Municipal Improvements will be held at Atlantic City, N. J., October 20, 21, 22 and 23. A. P. Folwell, secretary, 239 W. 39th street, New York City.

The annual convention of the American Gas Institute will be held October 21, 22 and 23. W. Bissell, assistant secretary, 29 W. 39th street, New York City.

The annual meeting of the Empire State Gas and Electric Association will be held in New York City, at the United Engineering Societies' Bldg., October 7. Among the subjects to be discussed are the following: Electric Meter Testing with Report of the Meter Committee; Affiliation with the American Gas Institute and the National Electric Light Association.

The first International Road Congress will be held in Paris, France, October 11-18, and promises to be a most important gathering. States and municipalities should be represented by their engineers. One of the early appointees is Clifford Richardson, who has been appointed as delegate representing the American Society of Civil Engineers, the State of New York and President Roosevelt.

The Cement Products Exhibition Company will hold its second annual cement show in the Coliseum, Chicago, Ill., February 18 to 24, 1909, since 44 per cent. of the vote was for this date, more than twice as many as for any other month. Last year's exhibit was the most satisfactory one that has been held anywhere, and even greater preparations are under way for the next. The exhibit is educational in its character and not alone a means of bringing direct business to exhibitors. C. H. Wood is secretary and treasurer.

The Municipal Engineers of the City of New York listened to an illustrated paper by Charles Goodman on "Bench Levels and New York City Datums" at its regular meeting September 23. On the 26th they made an inspection of the Manhattan bridge. C. D. Pollock, secretary.

The American Civic Association and the National Municipal League will hold a joint convention November 17 to 19 at Pittsburg, Pa. The former has recently issued in a handsome pamphlet the declaration of the governors of states adopted at the White House conference on the conservation of natural resources held in May, and the address of J. Horace McFarland, its president, on "The Value of Natural Scenery."

It is proposed to hold the next convention of the National Association of Cement Users in Louisville, Ky., early in February, 1909.

Civil Service Examinations.

The U. S. Civil Service Commission will hold examinations at the usual places as follows:

October 7—Apprentice plate cleaner and

engraver in Bureau of Engraving and Printing, Washington, D. C., at $500 a year entrance with promotions up to $1,200. Hydrographic draftsman in Coast and Geodetic Survey, at $900 a year.

October 9—Eight civil engineers with high-grade experience in highway or railway location and construction or both, at $2,000 to $2,500 a year; and five civil engineers with good experience in irrigation or reclamation engineering at not over $2,000 a year.

October 21, 22, 23—Skilled mechanical draftsman in 12 ordnance establishments in various parts of the country at entrance salary of $1,000 or $1,200 a year.

October 28—Examiner of textiles and mechanical appliances in Bureau of Engraving and Printing, at $1,400 a year.

Personal Notes.

H. L. Shaner has been re-elected city engineer at Lynchburg, Va.

E. H. Randall has been elected city surveyor at Fredericksburg, Va.

William R. Brown, a member of Brown & Layton, civil engineers of Pittsburg, died recently at Renova.

Erwin A. Hathaway has been elected city engineer, to succeed Edward J. Johnson, resigned, at Nashua, N. H.

Frederick P. Burr has resigned as superintendent of the Board of Water Commission at Middletown. Conn.

C. M. Saville, assistant engineer of the Isthmian Canal Commission, has had his office transferred from Gatun to Culebra.

B. F. Ellison, general manager of the Water, Light & Power Co., Superior, Wis., died September 1 at St. Paul, Minn., aged about 55 years.

Jeremiah Ahern has resigned from the U. S. Reclamation Service. Mr. Ahern has been in charge of the construction of the Shoshone Project since 1903.

Frank Scotten has been placed in charge of the construction of the Rainbow Falls dam for the Great Falls Water Power & Townsite Co., Great Falls, Mont.

F. H. Newell, of the U. S. Reclamation Service, sailed from San Francisco, September 15, to look into the water supply and irrigation possibilities of the Hawaiian Islands.

Proctor L. Daugherty has been appointed inspector of electric light plants in the office of the Supervising Architect of the Treasury Department, to succeed Julian E. Woodwell, resigned.

Hon. Chalkley Steelman Leeds, the first mayor of Atlantic City, N. J., immediately after its incorporation in 1854, died in that city September 11, aged 83 years. Mr. Leeds was mayor for three terms.

John T. Whistler, M. Am. Soc. C. E., for six years an engineer on the U. S. Reclamation Service, has entered upon a private practice in railroad work, irrigation, hydraulic mining, water supply and storage, with an office in the Chamber of Commerce Building, Portland, Ore.

W. A. Clark and C. C. Wilson were elected members of the street commission, at Columbia, S. C., August 25, to fill the places made vacant by the death of Col. J. Q. Marshall and the resignation of Mr. Wilson, who was elected again. William Barnwell was re-elected a member of the water-works commission.

J. Walter Ackerman, M. Am. Soc. C. E., formerly city engineer of Auburn, N. Y., and recently resident engineer of the New York Auburn & Lansing R. R. and the Ithaca Street R. R., has resigned the latter position to accept that of superintendent of the municipal water-works system of Auburn, N. Y.

Isham Randolph, Lyman E. Cooley and R. R. McCormick, of Chicago; Walter Reeves, of Streator, and R. R. Bourland, of Peoria, Ill., have been appointed by Governor Chas. S. Deneen, members of a deep waterway commission which is to investigate and report upon the rights and titles of the state in the water courses and lakes within and along its boundaries. The commission also includes five members from each branch of the state legislature.

MACHINERY AND TRADE

Lectures on Electrical Engineering.

Mr. C. L. de Muralt, of New York City, has been reappointed professor of electrical engineering at the University of Michigan for the coming year. During the winter semester Prof. Muralt will devote his attention to the consideration of the more general aspects of applied electricity. The course of lectures will include the discussion of (1) the characteristics and application of alternating and continuous motors, (2) the design, construction and operation of electric plants, (3) the principles and methods of transmitting, distributing and controlling alternating currents, (4) the calculation and operation of electric railways and (5) the management of electric properties, with special references to the commercial aspects of electrical engineering.

Corrugated Iron Culverts.

One of the popular improvements of the day is the corrugated iron culvert, which reduces to a minimum the amount of metal required to carry the weight coming upon it. Common steel sheets corrode too rapidly to be entirely satisfactory in

the comparatively thin form used for corrugated culverts, and galvanizing is not a complete protection for steel, since the corrosion is really due to an electrolytic action, the conditions for which are set up by the presence of impurities in the iron and moisture and acids in the air. Bulletin No. 30 of the U. S. Office of Public Roads says that "the purer the iron in respect to certain other metals which differ electro-chemically from iron, and the more carefully the lack of homogeneity and bad segregation are guarded against, the less likely are the electrolytic effects to become serious."

A PURE IRON CORRUGATED CULVERT.

Acting upon this suggestion the American Rolling Mill Co., of Middletown, O., have developed a process by which they manufacture rust-resisting sheets which they guarantee to be 99.86 per cent. pure iron. These sheets have the trade name "American Ingot Iron." They are corrugated and galvanized and are then ready for shipment to the location of the culvert. The accompanying cut is from a photograph of a section. The durability of pure iron in culverts is shown by the fact that the first corrugated culvert placed under the Watson patent in Fayette county is still in use after 14 years. It was of old-fashioned pure iron and was not galvanized, but merely painted. The American Ingot Iron is equally pure and is galvanized and should show equally long life.

Further information may be obtained of The American Rolling Mill Co., Middletown, O. The latest information received is that the standard of purity has been raised to 99.94 per cent. pure iron.

The Card Index for Price Lists.

Many foreign firms and some in this country are using the card index system for price lists, and the method is so convenient that it need only be tried to insure its adoption. A few exporting manufacturers prepare their price lists on regular index cards with perforation for the locking rod, and distribute them in this form. An excellent example of this has been received from the Buffalo Meter Co., Buffalo, N. Y., giving at the head the line, "American and Niagara Water Meters," and followed by a small cut of a meter to help catch the eye, and the net wholesale price list in American gold f. o. b. Buffalo, with boxed weight. The date of the list is also given. This card can be filed according to any desired alphabetical arrangement. The only suggestion the writer would make is that a small space be left in each of the upper corners for the insertion of such catch word as the filing clerk desires to use for his aid in classifying, particularly for use when the foreign word is not the same as the American word for the apparatus indexed.

The Buffalo Meter Co., Buffalo, N. Y., will doubtless send samples of their cards to any one interested in the system. Engineers, contractors and others can start their own card indexes on this line, and manufacturers can aid in getting them started by sending their price lists classified in detail and each class on its own card, so that they can be filed under their own names and not require cross-references.

A Family in the Pipe Trade.

The golden wedding of the original McWane was celebrated September 14, with sixty-three members of the four generations of the family present. Every male member of the family over school age is in the pipe business, and all are striving to maintain the high reputation which the founder of the family established as a foundryman years before the war. That they have done so is shown by the high reputation of the McWane Pipe Works, which now have two foundries at Lynchburg and Radford, Va., and an office at 220 Broadway, New York City. There is an individuality about their business and their methods of making it known which is pleasing and is productive of confidence.

R. C. McWane is making a reinforced cast iron culvert pipe which has some material advantages.

Hendricks's Commercial Register.

The sixteenth annual (1907) edition of this standard directory required 76 pages to index its contents, while the present edition requires 82 pages. As each page contains 412 classifications, the 6 additional pages contain 2,472 additional trade classifications, making for the 82 pages a grand total of 33,684 headings, each one of which represents the manufacturers, etc., of some machine, tool, apparatus, specialty or material.

The first edition was issued in 1891, and contained about 500 pages, while the present numbers over 1,300 pages and contains upward of 350,000 names and addresses, classified under 33,684 trade headings.

The first edition required only 8 pages to index its contents, with 206 classifications on each page, or a total of 1,648, and it was devoted solely to the building industries of the country, while the present edition covers not only these, but also the engineering, mechanical, railroad, electrical, mining, iron, steel, export and kindred industries. The difference between the first and the present edition will give some idea of the growth of the publication

and the appreciation with which it has been received. It is the only publication ever issued that is so classified that it can be used for either purchasing or mailing purposes.

Each annual edition is corrected. It is expressed to any part of the United States on receipt of $10.

The Uses of Asphalt.

A new book on asphalts, their sources and utilization, is almost ready for publication. It is by T. Hugh Boorman, the well-known civic engineer and asphalt expert, of 59 Pearl street, New York City. Some of the special subjects treated are asphalt for dustless roads, recent improvements in asphalt industries and general waterproof construction. The appearance of the book will be awaited with interest, as it should be what has long been wanted, a book of practical instruction on the many uses of asphalt.

In a Sewer for Sixty Years.

A recent examination of sewers built sixty years ago, in which Utica hydraulic cement mortar was used exclusively, showed them to be in perfect condition, it is reported, thus showing that the durability of natural cement is all that could be desired. Utica cement has been used in Chicago sewers and water tunnels for the past thirty years with the most satisfactory results from every point of view. Among these are the four miles of the 7-foot tunnel at the foot of Chicago avenue; the four miles of the 8-foot tunnel at the foot of Twelfth street; the mile of 6.25-foot tunnel at the foot of Sixty-eighth street; the two miles of the 6-foot tunnel near the foot of Sulzer street, and another one mile of 7-foot tunnel at the foot of Chicago avenue; also the 12-foot conduit in Fullerton avenue; the 16-foot intercepting sewer along the lake front, from Thirty-ninth to Seventy-ninth street, and the 11-foot intercepting sewer, as well as over a thousand miles of smaller brick sewers and the manholes and receiving basins connected with them.

Utica cement has now been in use 70 years and has conclusively proved its durability. An examination of the prices at which it is sold and the proportions in which it is used in the specifications for work will demonstrate its economy within the range of its freight rate limits.

The Utica Hydraulic Cement Co., Utica, Ill., will send booklets on request, showing what has been done with their product in street paving, in sewers and conduits, in building, etc., as well as their red book, which has long been a standard on the use of natural hydraulic cement. One of the more recent uses for natural cement is for laying brick. The demand of the times is for better buildings, and it is found that with present prices it is almost, if not quite, as cheap to use natural cement in making mortar as to use lime, and the cement mortar is much the stronger and more durable. Utica cement works smoothly, so that mortar made with it is easily worked and is quite satisfactory to the bricklayers, and neat work can be easily secured. Being stainless, the most delicately tinted brick can be laid with it without discoloration.

Asphalt Business Is Improving.

The East Iron and Machine Co., Lima, O., have just delivered one of their large one-car asphalt plants to H. P. Streicher & Co., Toledo, O., and have closed the contract for delivery within 15 days of another for the Texas Company, of New York City, to be delivered in Texas.

The company reports a good business during the past year and excellent prospects for the coming year. They attribute their success to the merit of their plant and to the value of MUNICIPAL ENGINEERING as their only advertising medium, as it has brought them inquiries from all parts of the United States.

The Municipal Asphalt Plant of Indianapolis, Ind.

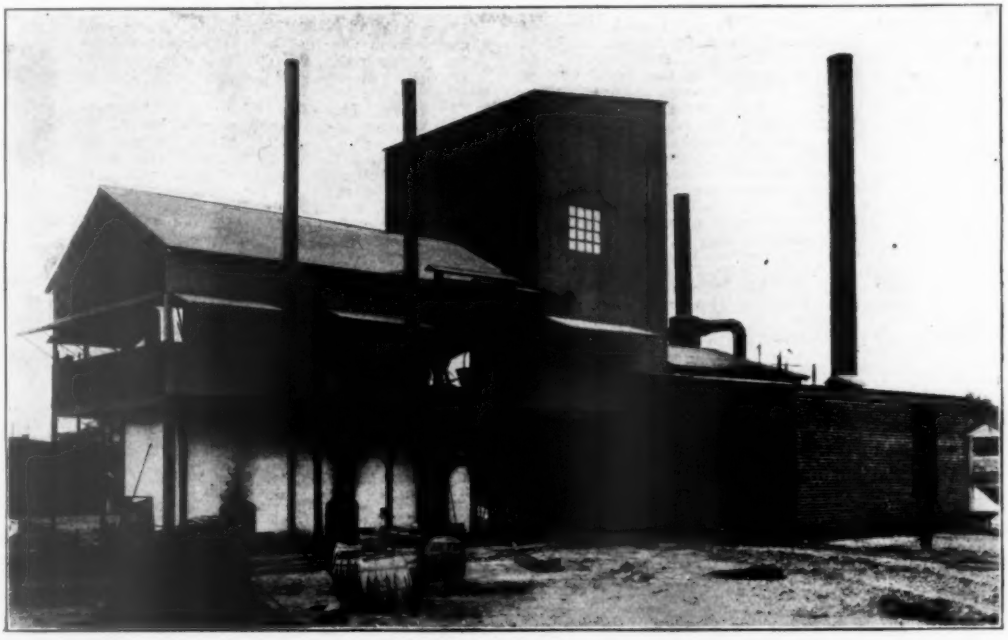
The accompanying illustration shows the new city asphalt paving and repair plant which was put into service in the early part of July of the present year. The contract price which the city paid Hetherington & Berner, the makers, was $15,625, for the plant complete in all respects, tested and turned over to the city ready for work. Since starting the plant, under the care of Mr. Frank Royse, foreman, and Mr. Sam Murray, superintendent, the plant has continued in constant operation during the regular working hours, excepting two or three days, when there was a shut-down while awaiting a supply of asphalt. The city of Indianapolis is particularly fortunate in possessing a very competent organization in charge of this work, all trained men, and the consequence is that exceptionally good work has been done, and at the minimum cost. The city is to be congratulated upon the success of this venture. The deplorable condition of the asphalt streets of Indianapolis is no longer a by-word. As far as the repair work has extended they are now in splendid condition.

The plant with which this work has been done represents the very latest improvements in the art of plant building. There are many features embodied in this installation that are to be found in no other plant in the United States. In a general way the design of the plant is similar to that built last season for the city of Columbus, O., but the Indianapolis plant has about one-third greater capacity, and has several features not possessed by the former. The makers of this plant claim that it is operated with less hand labor than any other plant ever built, also that the conduct of its various operations is so nearly automatic that the qual-

ity of the output of street mixtures is practically uniform and under full control.

There was no wood used in the construction. The building frame is made of steel and is covered with galvanized iron. The floors are of concrete, with a cement top finish. A dust collector, used in connection with the sand heater, collects all of the dust that is created during the process of heating and screening the sand, and the dust so collected is used in the mixer, thus reducing the amount of limestone dust to a small quantity. The limestone dust, which is the most disagreeable material to handle, on account of the dust, is carried from below to an overhead steel storage bin. From the latter it is automatically discharged, as required, into an automatic quantity weighing device, that deposits the requisite amount into the mixer, with each batch, without the intervention of any hand labor; thus only one man is required at the mixer, instead of two or more, as is generally the case. The sand dryer used in this plant embodies many recent improvements which have been made in the already well-known Hetherington sand dryers. It has been very much improved, especially in the matters of capacity and durability.

The yards of the city plant are always open to visitors who will first obtain permission at the yard office, and visiting officials from other cities are treated with courtesy by the superintendent.



THE HETHERINGTON ASPHALT PLANT OF THE CITY OF INDIANAPOLIS.

Trade Publications.

The striking things in the September bulletin of the Universal Portland Cement Co. are the descriptions of the floatable reinforced concrete caissons used at Algoma, Wis., and Aikens concrete walls made on a practically horizontal table and raised and set in position after the concrete has hardened.

The Rockwell Furnace Company, New York City, send two handsome catalogs of melting furnaces and portable heaters, which show the many uses to which they can be applied.

Browning steam shovels are shown in bulletin No. 33 of the Browning Manufacturing Co., Mansfield, O.

One of the handsomest catalogs reaching this office is that of the Reinforced Concrete Pipe Co., of Jackson, Mich., which is made up from cuts and illustrations showing the process of manufacture of their reinforced concrete pipe in various cities throughout the United States.

The Bausch & Lomb Optical Co., Rochester, N. Y., send circulars regarding the engineering instruments which they manufacture, having made Geo. N. Saegmuller an associate in their business, thus insuring the same high standard in this line that they have maintained in their optical instruments.

Contractors' dump cars is the subject of catalog 33-D of the Kilbourne & Jacobs Manufacturing Co., Columbus, O.

The Expanded Metal and Corrugated

Bar Co., St. Louis, Mo., have issued an announcement of the placing on the market of two new types of corrugated bars, one square, with rounded corners and corrugations projecting on each side, those on adjacent sides being staggered; and one cylindrical, with two longitudinal corrugations and staggered semi-circular corrugations.

Trade Notes.

BRICK.

Auburn, Wash.—The Northern Clay Products Co. has been reorganized under the name of the Northern Clay Co., and will manufacture building terra cotta, fire brick and other clay products.

CEMENT.

Detroit, Mich.—The Association of American Cement Manufacturers, while in convention here, decided September 17 that the cement companies of the west are to form a new holding company, the Northern American Cement Company, similar to and affiliated with the eastern concern. Its headquarters will be in Chicago or Detroit. It will not be a merger, as all the concerns entered will retain their corporate identity. Restraint of trade or price increase is not intended, but merely distribution of territory and prevention of cut-throat competition.

Portland, Me.—The Bangor & Boston Portland Cement Co. has been incorporated by J. H. McLauchlan, of Toronto; Edward T. Fenley, Henry Cleaves Sullivan, Lawrence E. Cummings, Percy M. Andrews, Portland; Linwood F. Crockett, Westbrook.

Baker, Wash.—The Superior Portland Cement Co. has started its plant here.

Sibley, Ia.—The Sibley Cement Co. contemplates making extensive improvements to its plant.

San Bernardino, Cal.—The Victor Portland Cement Co. is preparing to develop cement and lime deposits near Victorville, 60 miles across the mountains, on the banks of the Mojave river. The large plant for the reduction of the cement will be located at Victorville.

Everett Station, Boston, Mass.—The Sanitary Cement Co. has purchased a large tract of land and will erect a cement plant at once.

Omaha, Neb.—The Benson Cement Works have been incorporated here by F. A. Bailey, C. C. Williams and K. R. Parker.

Wampum, Pa.—The Crescent Portland Cement Co. has begun the erection of a cement plant. The buildings will be constructed of reinforced concrete, with steel trusses and cement tile roof.

Saugerties, N. Y.—The Knickerbocker Portland Cement Co. has purchased property and will erect a cement plant.

Huntington, Ind.—The J. W. Shock Cement Co. has been organized here by J. W. Shock, C. B. Williams and C. A. Butler.

New York City.—The Marvin Cement Preservative Co. has been incorporated here for the manufacture of cement, paints, pigments, etc., by Mark and D. Walton, of Birmingham, and William P. Snyder, 17 Battery Place.

Portland, Ore.—The Portland Cement Co. has been incorporated under the laws of Utah and will erect a large cement plant near here. C. W. Nibley, Salt Lake City, is president; J. N. Teal, Portland, vice-president; Alexander Nibley, Salt Lake City, secretary-treasurer.

The Sandusky Portland Cement Co., Sandusky, O., is furnishing several tons of waterproof compound which is being used in connection with Portland cement for lining a shaft being sunk from the top of a hill into a railway tunnel at Wilkes-Barre, Pa. The work is being done by R. D. Isaacs & Son, contractors at that place. It will be understood by parties who are interested in waterproofing various cement constructions that an air shaft of this kind must have a waterproof lining; otherwise the surface and drainage water from the hill would cause the tunnel at all times to be wet. The same company furnished their Medusa white Portland cement for the government rifle ranges recently finished at Camp Perry, Ohio, which construction was done by the R. H. Aiken Engineering Co.; also for the new Senate office building at Washington, D. C.

CONCRETE BLOCKS.

Cleveland, O.—The Concrete Stone and Construction Co. has been incorporated by John O. Tomisko, M. G. Cameron, George Maceski, Valentine Polomski and Joseph S. Ondrey.

Ottumwa, Ia.—The Ottumwa Concrete Tile Co. has been incorporated by L. R. Cremer, W. F. Creath, Fred M. Taylor, W. C. Boone and L. T. Crisman. The company is erecting a plant for the manufacture of concrete tiling, brick, concrete fence posts, building blocks, etc.

South Euclid, O.—The Euclid Concrete Co. has been incorporated by A. W. Neale and others.

Duluth, Minn.—The Duluth Cement Block and Building Co. has been incorporated by M. B. Cullum, John B. Kelley, E. L. Toomey, O. McDonnell, R. W. Nichols and W. H. Wells.

Pine River, Minn.—J. W. Rice & Sons have established a cement block and cement brick plant.

Spicer, Minn.—A plant is being built here for the manufacture of cement building blocks, cement tile and brick, by L. F. Larson, of Mora, Minn.

PURCHASE OF MACHINERY.

Unadilla, N. Y.—Special.—A. J. Fairbank advises us that he will be in the market for a concrete mixer next spring.

Bastrop, Tex.—Special.—S. E. Haines, Box 640, advises us that he is in the market for A. C. motors, centrifugal pumps, W. P. wires and line material.

Fall City, Neb.—Special.—French McDonald is in the market for one triplex pump driven by motor, and for packing, oil, pump repairs, etc.

Lima, Peru, S. A.—Special.—H. F. Letts, concha 92, advises us that he desires catalogs for cement factories and construction materials of all kinds.

Topeka, Kans.—Special.—Walter J. Arnold, asst. cy. engr., is in the market for a concrete hand mixer and cement block machine.

Ashland, Pa.—Special.—R. J. Williams is in the market for street paving machinery and tools for cleaning pavements.

PURCHASE OF MATERIALS.

Topeka, Kans.—Special.—Walter J. Arnold, asst. cy. engr., advises us that he is in the market for 300 barrels of Portland cement.

Lima, Peru, S. A.—Special.—R. F. Letts, concha 92, advises us that he desires to purchase construction materials of all kinds.

LIGHT, HEAT AND POWER.

Great Falls, Mont.—The Great Falls Water Power and Town Site Co. has established an office for the engineering and

construction departments in the office buildings of the old silver smelter and will maintain the same during the construction of the Rainbow Falls dam. Frank Scotten will have charge of the construction work.

MISCELLANEOUS.

Springfield, Ill.—The question of adopting a uniform accounting system in the county offices is being considered by the board of supervisors. The system installed in the city offices by Marwick, Mitchell & Co., of Chicago, has proved of great value to the city.

San Francisco, Cal.—Prices for materials on recent work were as follows: Common red brick, $9 per M.; fire brick, $45 per M.; cement, $2.95 per bbl.; sand, $2 a load; broken stone, $3.90 a load.

Patents on Concrete Posts and Poles.

848,847. Fence Post. Wm. Petersen, Benton County, Iowa.

849,760. Mold for Cement Posts. Wm. E. Varney, Wellman, Iowa.

850,082. Fence Post. Jas. E. Wright, Omaha, Neb.

851,503. Mold for Concrete Posts. Jas. P. Donovan, Georgetown, Ky.

852,049. Post and Molding Machine. Jas. G. Ash, Manchester, Iowa.

852,421. Fence Post. A. C. Davis, Battle Ground, Ind.

853,069. Machine for Making Fence-Posts. Robert L. Dennison, Kansas City, Mo.

855,353. Post Form Device. Wm. E. Snyder, LaGrange, Ind.

855,999. Reinforcement for Cement Fence Posts. Edward R. Stowell, Adams Co., Ind.

858,231. Concrete Post and Adjustable Fastener for Wire Fences. Alfred J. Taylor, Waterville, O.

858,372. Fence Post (and Manner of Fastening). Wm. H. Crum, Houston, Tex.

859,603. Fence Post. John W. Hogans, Barnum, Iowa.

859,882. Fence Post. Nathaniel W. Hoskins, Almond, Wis.

859,883. Machine for Making Concrete Posts. Nath. W. Hoskins, Almond, Wis.

862,355. Composite Fence Post. John Stoneburner, Warsaw, Ind.

862,522. Composite Fence Post. Ellis T. Silvius, Indianapolis, Ind.

863,118. Cement Fence Post. Joseph G. Trimble, Maineville, O.

865,179. Composite or Concrete Post. Harvey G. and Joseph W. Hays, Chicago, Ill.

866,653. Mold for Cement Posts. Chas. Hutchins, Pataskala, O.

866,857. Fence Post. Joseph H. Graham, Kempton, Ind.

867,335. Cementitious Pole for Supporting Overhead Wires and the Like. Wm. M. Bailey, Richmond, Ind.

867,458. Fencing Fastener. Jonas H. Wiest, Indianapolis, Ind.

869,252. Telegraph Pole, Fence Post and the Like. Hezekiah Miller, Ft. Morgan, Colo.

870,162. Cement Fence Post and Line Wire Fastener Therefor. Wm. M. Gibbs, Anderson, Ind.

870,554. Fence Post. Geo. I. Gargett, Alma, Mich.

870,858. Telegraph Pole. Frederick H. Tidnam, Okalahoma, Okla.

874,453. Cement Fence Post. Wm. W. Stout, Somerset, Ind.

874,513. Plastic Fence Post. Hugh P. Libhart, Troup, Tex.

875,039. Fence Post. Chas. S. Beebe, Peru, Ind.

876,027. Fence Post Mold. Benj. Tanner, Sturgis, Mich.

876,247. Artificial Post. Herbert G. Thompson, New York.

877,638. Fence Post. Chas. S. Dougherty, Milwaukee, Wis.

Patents on Concrete Burial Vaults and Tombstones.

849,435. Burial Vault. Theo. A. Stevenson, Lansing, Kan.

852,080. Burial Case. Jos. F. Russell, Battle Creek, Mich.

859,014. Burial Vault. Nath. B. Shallenberger, Scottdale, Pa.

859,062. Method of Making Concrete Tombstones. Marion J. Hendley, Athens, Tex.

859,193. Cement Burial Vault. Albert E. Beall, Clinton, Iowa.

863,354. Imperishable Grave Marker. John W. Brownsberger, Bowling Green, O.

864,241. Cement Burial Vault. Wm. W. Gipe, East Germantown, Ind.

870,045. Burial Vault Mold. John M. Pruett and Wm. Ard, Rockville, Ind.

872,241. Grave Construction. Walter Livingston, Hastings, Neb.

877,095. Burial Vault. Wm. C. Laechle, Chicago, Ill.

Patents on the Manufacture of Cement.

849,730. Pebble Mill. Geo. S. Emerick, Nazareth, Pa.

850,750. Cement Kiln. Wm. H. Harding, Philadelphia, Pa.

850,778. Process of Making Hydraulic Cement. Emil Mueller, Alsen, N. Y.

851,247. Waterproof Portland Cement and Process of Making Same. Spencer B. Newberry, Sandusky, O.

851,637. Lining for Pebble Mills. Max F. Abbe, New York, N. Y.

851,686. Concrete Mixer. John Muir and Chas. H. Herod, Brantford, Ont.

852,616. Gypsum-Burning Kiln. Frederick Ranthel, Winsheim, Germany.

854,342. Manufacture of Hydraulic Cement. Bernard Enright, South Bethlehem, Pa.

851,765. Cement Kiln. Thos. M. Morgan, Longue Pointe, Que.

849,873. Cement Kiln. John S. Wentz, Philadelhpia, Pa.

858,129. Lining for Pebble Mills. Max F. Abbe, New York City.

860,685. Method of and Apparatus for Burning Cement. Thos. Morgan, Longue Pointe, Que., Can.

861,241. Portland Cement and Process of Manufacturing the Same. Thos. A. Edison, Llewellyn Park, Orange, N. J.

861,699. Mode of Producing Cement Clinker. Henry G. Barnhurst and Jas. W. Fuller, Jr., Catasauqua, Pa.

864,045. Method of Burning Cement in Rotary Kilns. Benjamin H. Thwaite, London, England.

864,068. Manufacture of Cement and Other Products. August P. Bjerregaard, Mineola, N. Y.

864,816. Rotary Kiln. Wm. R. Warren, New York, N. Y.

876,602. Cement Burning Furnace. Willoughby E. Snyder, Nazareth, Pa.

IMPROVEMENT AND CONTRACTING NEWS

PAVING.

Newark, N. J.—Governor Fort, in an address at Long Branch Sept. 3, outlined a plan for an ocean boulevard, which, according to his ideas, would be 125 mis. long and will cost within $400,000.

Washington, D. C.—Among the first of the number of bills which will be introduced at the next session of Congress will be one providing for the construction of the Lincoln highway, in honor of the centennial of the birth of Abraham Lincoln. The highway will begin at the White House and run in a practically straight line to the battlefield of Gettysburg. It will cost about $7,000,000.

CONTEMPLATED WORK.

Beverly, Mass.—Paving is contemplated for Cabot st.

Winona, Minn.—Brick paving is contemplated for W. 5th st.

Monmouth, Ill.—E. 5th ave. from 3rd to 11th sts. will be paved.

Walla Walla, Wash.—About 4 blocks of W. Main st. will be paved.

Paynesville, Minn.—The construction of several cement sidewalks is contemplated.

Madison, N. J.—The improvement of several streets in this town is contemplated.

Elgin, Ill.—About 1-mi. of asphalt pav- in N. Spring st. is contemplated.

Aberdeen, Wash.—Plans for paving H st. will be prepared by the city engineer.

Indianola, Ia.—Paving, with curbing and gutters, is contemplated for 8 streets.

Jackson, Miss.—The construction of concrete sidewalks is contemplated.

Little Falls, Minn.—The construction of several new sidewalks is contemplated.

Dunmore, Pa.—An ordinance has been passed providing for the paving of Blakely st.

Sedalia, Mo.—This city will pave 9 blocks of Moniteau ave. C. E. Parker, cy. engr.

Denison, Tex.—The property owners in block 100, on S. Rusk ave., have agreed to pave.

Bellingham, Wash.—The estimated cost of grading and graveling Lake st. is $17,132.

Moorhead, Minn.—Council is taking action preparatory to repaving the business streets.

East St. Louis, Ill.—An ordinance has been passed providing for the improvement of 26th st.

Jackson, Mich.—Will vote in November on the issue of $150,000 bonds for permanent improvements.

Mason, Mich.—Plans and specifications are being prepared for paving Main and Ash sts. with brick.

Springfield, Mo.—Plans have been prepared for 4,000-lin. ft. of brick paving. G. W. Hackney, cy. clk.

Washington, D. C.—Riggs road, from Rock Creek Church road to the District line, is to be resurfaced with gravel.

Wheeling, W. Va.—A resolution has been adopted providing for the paving of the National Pike over the hill to Fulton.

Oakland, Cal.—An ordinance has been approved providing for an appropriation of $4,500 for resurfacing E. 12th st.

Buffalo, N. Y.—The park commissioners are considering the repaving of Richmond ave. with macadam instead of asphalt.

Guthrie, Ok.—W. W. Miller, cy. engr., has been directed to prepare maps and estimates for about 112 blocks of paving.

Salt Lake City, Utah—Plans for constructing 52-mis. of cement sidewalks are being prepared by Louis C. Kelsey, cy. engr.

Carthage, Mo.—Plans are being prepared and bids will be asked at once for 14 blocks of brick paving. I. F. Shannon, cy. clk.

Springfield, O.—Specifications will be prepared for paving S. Fountain ave. with brick and asphalt. M. J. Baihn, cy. engr.

Crawfordsville, Ind.—A resolution has been passed for paving Green st. from College to Franklin sts. Henry B. Hulett, cy. clk.

St. Paul, Minn.—The bd. of pub. wks. has reported favorably on the proposed construction of 200 cement crossings in the 7th ward.

Wallace, Idaho—A petition is being circulated asking for the construction of a wagon road from a point on Big Creek to the Powhatan mine.

Granger, Wash.—The Petrolithic Paving Co., of Los Angeles and Spokane, have made a proposition to this city for paving the streets.

Saginaw, Mich.—The question of removing the brick paving in Washington st., from Janes to Johnson, and repaving with asphalt is being discussed.

Jersey City, N. J.—The finance bd. concurred in specifications, Sept. 14, for paving Bergen ave., from Myrtle to Communipaw ave., with wood blocks.

Victoria, B. C.—The city engineer has recommended creosoted block paving for Belleville st., from Government to St. John sts., at a cost of about $28,526.

Peoria, Ill.—Bids will be asked for soon for paving E. Washington st. in East Peoria, for a distance of 4,100-ft., with brick, with cement curbing and cement walks.

Quincy, Ill.—A resolution was adopted Sept. 8 providing for the paving of Kentucky st. from 12th to 18th sts. with combination curbing and gutter of concrete.

Wellington, Kas.—Special. H. A. Rowland, cy. engr., says resolutions have been passed to pave 9 blocks of the main street of this city. Geo. H. Hunter, chmn. paving com.

Aberdeen, Wash.—The city engineer has been directed to prepare plans and specifications for paving H st., from River to Market, with vitrified brick or creosoted blocks.

Newcastle, Ind.—Petitions have been filed asking for the paving of a street through Lewisville; 2 streets in Sulphur Springs; a highway in Fall Creek twp. This city will also petition for paving.

Waukegan, Ill.—Ordinances have been passed for constructing cement sidewalks in several streets and for resurfacing and covering with mineral rubber asphalt ma-

cadam a portion of Sheridan road. H. Thacker, cy. clk.

Binghamton, N. Y.—The bd. of supvrs. received, Sept. 12, plans and specifications for building the Kirkwood River road, which will extend 1.79-mis. from the State line near Riverside to the intersection of the proposed State line and the present improved State Hospital road.

Lewiston, Mont.—Paving is contemplated for 4 blocks of Main st.

Great Falls, Mont.—Citv council has passed resolutions providing for grading and improving 7th st.

Buffalo, N. Y.—Special.—Plans are being prepared for repaving Richmond ave., from the Circle to Bidwell Parkway, 6,700 ft. in length.

Washington, D. C.—The annual estimates of the District Commissioners will include the macadamizing of Chestnut, Cedar, Delia and 6th sts., Eastern ave. and Piney Branch road.

CONTRACTS TO BE LET.

Shanagolden, Wis.—Bids are asked until Oct. 10 for street paving. Town clk.

Bluffton, Ind.—Bids are asked until Oct. 8 for constructing 17 gravel roads. Co. audt. Garrett.

Delphi, Ind.—Bids are asked until Oct. 5 for constructing 4 gravel and macadam roads. M. G. Haun, co. audt.

Tipton, Ind.—Bids are asked until Oct. 9 for constructing about 1-mi. of gravel road. J. F. Barlow, co. audt.

Crownpoint, Ind.—Bids are asked until Oct. 5 for constructing gravel roads. Chas. A. Johnson, co. audt.

Frankfort, Ind.—Sealed bids are asked until Oct. 7 for constructing 5 roads. Chas. F. Cromwell, co. audt.

Liberty, Ind.—Sealed bids are asked until Oct. 5 for gravel paving in Union and Harmony twps. Clinton Gardner, co. audt.

Jacksonville, Fla.—Sealed bids are asked until Oct. 12 for grading, curbing and paving. Philip Prioleau, cy. engr.

Anderson, Ind.—Bids are asked until Oct. 3 for constructing about 9-mis. of gravel roads. Wm. T. Richards, co. audt.

Corlett (Cleveland P. O.), O.—Sealed bids are asked until Oct. 6 for grading sundry streets. W. H. Jantzen, vil. clk.

Jasper, Ind.—Sealed bids are asked until Oct. 5 for macadamizing 4-mis. of free turnpike road. M. A. Sweeney, co. audt.

New Ulm, Minn.—Sealed bids are asked until Oct. 6 for constructing a cement walk in Washington st. Ernst Wicherski, cy clk.

Fostoria, O.—Bids are asked until Oct. 2 for constructing two ½-mi. sections of pike. J. I. Arnold, chmn. bd. trustees.

Madison, Ind.—Bids are asked until Oct. 6 for grading, paving and macadamizing roads Nos. 1 and 2, Graham twp. Gaylord F. Crozier, co. audt.

Hartford City, Ind.—Sealed bids are asked until Oct. 6 for constructing a macadam road in Harrison and Jackson twps. L. W. Daugherty, co. audt.

Bayonne, N. J.—Bids are asked until Oct. 6 for 73,800-sq. yds. of bitulithic or asphalt block paving in Broadway st. W. C. Hamilton, cy. clk.

Clearfield, Pa.—Bids are asked until Oct. 6 for constructing 14,175-ft. of state road in Decatur twp. Jos. W. Hunter, state highway comr.

South Bend, Ind—Sealed bids are asked until Oct. 6 (readvertisement), for grading, curbing and sidewalks in May st. A. J. Hammond, cy. engr.

Olympia, Wash.—Sealed bids are asked until Oct. 3 for clearing, grubbing, grading, draining and bridging state roads Nos. 2 and 34. Sec'y. state highway bd.

Indianapolis, Ind.—Sealed bids are asked until Oct. 7 for furnishing crushed stone for turnpike roadways in Marion county. John McGregor, chmn. co. comrs.

Cincinnati, O.—Bids are asked until Oct. 10 for constructing drains and grading the infield of the Fair Grounds at Carthage. D. L. Sampson, secy. Hamilton Co. Agricultural Society.

Atlanta, Ga.—Bids are asked until Oct. 3 for constructing 20,000 to 25,000-sq. yds. of macadam roadway in Ponce de Leon ave., Druid Hills, Atlanta. D. Lee Wardroper, engr., 810 Candler Bldg.

Corydon, Ind.—Bids are asked until Oct. 6 for constructing gravel roads. Co. comrs.

Hannibal, Mo.—Sealed bids are asked until Oct. 5 for paving an alley. Aug. Scheineman, cy. clk.

Youngstown, O.—Bids are asked until Oct. 2 for paving W. Boardman st. W. H. McMillin, clk. B. P. S.

Lafayette, Ind.—Bids are asked until Oct. 7 for constructing a gravel road. John P. Foresman, co. audt.

Clearfield, N. J.—Bids are asked until Oct. 6 for constructing 14,175 ft. of state road in Decatur twp. State highway dept.

Westfield, N. J.—Bids are asked until Oct. 5 for macadamizing, curbing and guttering certain streets. Llovd Thompson, town clk.

Muncie, Ind.—Bids are asked until Oct. 6 for constructing crushed stone macadam roads and brick paved highways. Jos. E. Davis, co. audt.

Cincinnati, O.—Sealed bids are asked until Oct. 16 for improving Dawson and Rittenhouse roads. Stanley Struble, prest. co. comrs.

New York City.—Bids are asked until Oct. 5 for repairing asphalt pavement on North and East rivers. Allen N. Spooner, comr. of docks.

Bayonne, N. J.—Sealed bids are asked until Oct. 6 for constructing 73,800 sq. yds. of bitulithic or asphalt block paving. W. C. Hamilton, cy. clk.

Dayton, O.—Bids are asked until Oct. 2 for improving Findlay st., involving the following: 2,565 ft. of combined cement curb and gutter; 2,565 ft. of grading and graveling of sidewalks; 1,320 ft. of grading and graveling of roadway; 225 sq. ft. of street and gutter crossings; 160 lin. ft. 15-in. and 60 ft. of 12-in. pipe. W. A. Budroe, clk. B. P. S.

CONTRACTS AWARDED.

Portsmouth, O.—The contract for paving Front st. was awarded to Monroe & Sons, for $18,000.

Cedar Rapids, Ia.—McCabe & Hollis secured the contract for improving N. 7th st. for $13,410.

Everett, Wash.—Thorsvig & Miley secured the contract for improving Colby ave. for $9,323.87.

Erie, Pa.—J. J. and M. E. Doyle secured the contract for paving W. 3rd st. with brick for $24.110.

Olympia, Wash.—Contracts for paving 4th and Columbia sts. was awarded to the Lister Construction Co.

Baldwinsville, N. Y.—The contract for paving Oswego st. with brick was awarded to C. O. McComb, for $11,006.

Canton, O.—The contract for grading, curbing and paving East Lake st. was awarded to T. K. Turnbull, for $8,071.

Cincinnati, O.—D. O. Schmidt was awarded the contract for improving Blue Ash ave. and Plainfield Pike for $11,155.

Greenville, O.—The contract for improving S. Central ave. was awarded to Jacob R. Stocker and Thos. Barry, for $5,908.

Idaho Falls, Idaho—The contract for macadamizing in dist. No. 2 was awarded

to E. P. Henry and W. W. Keefer, for $17,725.

Saginaw, Mich.—The contract for paving 7th st. was awarded, Sept. 11, to the Cleveland Trinidad Paving Co., for $7,271.51.

McKeesport, Pa.—The contract for repairing Shaw ave. and paving Beaver st. was awarded, Sept. 8, to J. W. Butler, of Portvue, Pa.

Notre Dame de Grace, Que.—The contract for widening and leveling Sherbrooke st. was awarded to Henault & Heffernan, for $29,625.

Atlantic City, N. J.—The contract for paving Princeton ave. with bitulithic was awarded to the United Paving Co., for $50,817.25.

Marblehead, Mass.—The contract for reconstructing Atlantic ave. was awarded, Sept. 3, to McDonough & Co., of Swampscott, Mass., for $5,636.

Albany, N. Y.—M. F. Dollard has been awarded contracts for improving Broad st. and McCarthy ave. for $4,965 and $3,567 respectively.

Haverhill, Mass.—The contract for constructing granolithic sidewalks was awarded, Sept. 2, to W. F. Duffee & Co., at $1.50 a sq. yd.

Jersey City, N. J.—The contract for repaving Hudson st. with wooden blocks was awarded to the United States Wood Paving Co., Sept. 14.

Fond du Lac, Wis.—George H. Stanchfield was awarded the contract for constructing cement pavements in Union and Military sts., for $1,481.

Bedford, Ind.—The contract for constructing 6-mis. of gravel road in Marshall twp. was awarded to McNee Dunn, of Anderson, for $18,000.

Westchester, Pa.—The contract for constructing 20,360-ft. of state road in Penn twp. was awarded to F. W. Bornemann & Co., of Lansdowne, Pa.

Brownsville, Tenn.—The contract for graveling 6-mis. of streets was awarded to the Camden Gravel Co., of Huntington, Tenn., for about $30,000.

Bloomington, Ind.—The contract for furnishing 25,000-sq. yds. of creosoted paving blocks was awarded to the Indiana Creosoting Co., of this city.

San Antonio, Tex.—The General Supply & Construction Co., of Ft. Worth, was awarded the contract for 21,000-sq. yds. of paving in Houston st.

Blountville, Tenn.—The contract for grading and macadamizing about 25-mis. of road was awarded to the Kreis-French Construction Co., of Knoxville, Tenn.

Vancouver, B. C.—Cotton & Campbell secured the contract for paving Homer st. and Christian & Hartney the contract for paving Richards st. with blocks.

Southington, Conn.—The contract for constructing about 16,000-sq. yds. of macadam road in the borough limits was awarded to C. W. Tryon, of Meriden, Conn.

Vincennes, Ind.—Contracts for constructing gravel roads were awarded, Sept. 8, as follows: Wm. Robe, $8,550; O. W. Holmer, $2,084; Thomas Horrall, $24,435.

Chattanooga, Tenn.—The Southern Paving & Construction Co. was awarded the contract for paving Rossville ave., from Main st. to East End ave., with brick, for $28,779.87.

Tuscumbia, Ala.—The contract for constructing about 5-mis. of concrete sidewalks was awarded to Hager & Morris, of Sheffield, Ala., at $1.20 a sq. yd., or about $11,000.

Shelbyville, Ind.—The contract for constructing the Halloron macadam road in Noble twp., 1½-mis. long, was awarded to William Aery, of Waldron, Ind., for $4,175.

Ottumwa, Ia.—The contract for constructing 22,000-sq. yds. of vitrified brick paving and 11,000-ft. of Portland cement curbing was awarded to J. C. Blunk, for about $50,000.

Dublin, Ga.—A contract for paving Jefferson and Jackson sts. with vitrified brick was awarded to the Georgia Engineering Co., of Augusta, Ga., at $2.07 a sq. yd., or $35,604.

White Plains, N. Y.—Contracts for vitrified brick paving were awarded recently as follows: 4,300-sq. yds., E. L. Erbeck, $2.48 a sq. yd.; 3,700-sq. yds., Tony Richards, $2.20 a sq. yd. L. B. Kinsey was also awarded a contract, Sept. 8, for 46,140-sq. yds. of rock asphalt paving at $1.89 a sq. yd., 65 cts. a lin. ft. for combined curb and gutter, and 20 cts. a cu. yd. for earth excavation.

Milwaukee, Wis.—Asphalt paving contracts were awarded, Sept. 15, as follows: Repaving 6th st., White Construction Co., $1.85 a sq. yd.; paving Downer ave., Badger Construction Co., $2.23 a sq. yd.

Hot Spring, Ark.—The contract for paving Malvern, Ouachita and Central aves. was awarded to the Southern Bitulithic Co., of Nashville, Tenn., and Rudolph S. Blome, of Chicago, for about $100,000.

Wilkes-Barre, Pa.—The contract for constructing 12,210-sq. yds. of brick paving and curbing in Hancock, Washington and Grant sts. was awarded to the H. G. Mulock Co., of Atlantic City, N. J., for about $25,000.

Cedar Rapids, Ia.—M. Ford was awarded the contract for brick paving, Sept. 8, as follows: Purington brick block, $1.58 a sq. yd.; curbing, 46 cts. a lin. ft.; resetting curbing, 17 cts. a lin. ft.; grading, 29 cts. a cu. yd.

Tulsa, Okla.—Paving contracts were awarded, Aug. 31, as follows: asphalt paving in N. Cheyenne and N. Main sts., R. F. Conway & Co., of Chicago, $57,000; brick paving on North Side, New State Paving & Construction Co., $10,000.

Jacksonville, Fla.—The contract for paving New York ave., from McGirt's creek to the new Country Club grounds, a distance of 1-mi., was awarded to the Logan Fuel & Supply Co., at 85¼ cts. a sq. yd. for coquina and Portland cement.

Rochester, N. Y.—Whitmore, Rauber & Vicinus, 270 South ave., was awarded the contract, Sept. 3, for paving Charlotte st. with trap rock for $8,479, and the contract for gravel paving in Schaefer st. was awarded to Holder & Bauman, for $4,460.

Saranac Lake, N. Y.—The contract for paving Main and Depot sts. and Broadway and Bloomingdale aves. with Mack brick and building macadam roadways in Upper Broadway, E. Main, Church and River sts. and Flower ave. was awarded to Eldridge & Grannis.

Salt Lake City, Utah—Special. Louis C. Kelsey, cy. engr., advises us that contracts were awarded, Sept. 11, as follows: curb and gutter extension No. 7, J. D. Hanley, $42,131.34; grading, curbing and gutter extension No. 18, P. J. Moran, $14,457.95.

Toledo, O.—The contract for paving Glenwood ave. and Putnam st. with asphalt was awarded to H. P. Streicher for $11,001 and $3,109 respectively. The contract for paving Boody st. and an alley was awarded to S. J. Pickett, for $4,472 and $3,098 respectively.

Warren, O.—The contract for constructing the Vienna ave. road and Canfield road was awarded to Waldeck & Ready, of this city. Chinnock Bros. secured the contract for building a road leading into the city and F. L. Geiger will build the Newton Falls roads.

Scranton (Pascagoula P. O.), Miss.—

The contract for constructing about 100,000 sq. yds. of concrete sidewalks, 20,000-lin. ft. of concrete combined curb and gutter, crossings and culverts was awarded, Sept. 2, to Pierson & Richardson, of Meridian, Miss., for $26,782.

Washington, D. C.—The contract for paving the roadway of Anacostia bridge and the roadway of a bridge across the B. & O. R. R. track at Monroe st. extension, aggregating 3,525-sq. yds. of sheet asphalt, was awarded, Sept. 3, to the Brennan Construction Co., of Washington, for about $5,000.

Chicago, Ill.—Paving contracts were awarded, Sept. 18, as follows: alley, brick, Central Paving Co.; alley, brick, John A. McGarry & Co.; Flourno st., asphalt, Barber Asphalt Paving Co.; Leland ave., blast furnace slag, Union Paving Co.; S. Robey, 24th and other streets, asphalt, Barber Asphalt Paving Co.

Springfield, Ill.—Paving contracts were awarded, Sept. 12, as follows: Capitol ave., brick, Capital City Construction Co., $1.47 a sq. yd. for paving and 48 cts. a ft. for curbing; Glenwood ave., brick, John E. Bretz, $1.55 and 45 cts.; Scarritt and Williams sts., asphalt, Capital City Construction Co., $1.73 and 49 cts.

Newington, Conn.—A contract for constructing 2,100-lin. ft. of telford road, cobblestone gutters, retaining wall and railing on the Berlin turnpike was awarded to Frank Arrigoni & Bro., of Durham, Conn.; at $9.15 a lin. ft. for macadam, $2.65 for telford, $1.10 for rubble drain, $4.20 a cu. yd. for wall, 35 cts. a sq. yd. for cobble gutters.

Portland, Ore.—Contracts have been awarded for improving streets as follows: William ave., Warren Construction Co., $16,786.44; E. 11th st., O'Neil & Co., $3,665.05; E. 41st st., Giebisch & Joplin, $3,000.02.

Delphi, Ind.—Contracts for constructing gravel roads have been awarded as follows: Road No. 1, Thompson & O'Conor, Delphi, $3,300; road No. 2, O'Conor & Son, Delphi, $1,645; road No. 3, E. F. Pierce, Delphi, $5,990; No. 4, E. J. Barnard, Delphi, $9,327; road No. 5, Halloran & Haverstick, Noblesville, Ind., $10,587.

Muskogee, Ok.—The contract for constructing bituminous macadam paving was awarded, Sept 8, to Peter J. McNerney, of this city, as follows: 43,931 sq. yds. 2-in. bituminous concrete pavement, 5-in. base, $1.84; 21,170 cu. yds. earth excava., 15 cts.; 25,360-lin. ft. combined curb and gutter, 60 cts.; 15 manholes, ea., $30; 34 catch basins, ea., $20; 765-lin. ft. 10-in. terra cotta pipe sewer, 63 cts.; 760-lin. ft. 12-in., 73 cts.; 320-lin. ft. 15-in., 83 cts.; 340-lin. ft. 18-in., $1.05; 415-lin. ft. 21-in., $1.30; 805-lin. ft. 24-in., $1.90; 1,400-lin. ft., 27-in., $2.20; 1,100-lin. ft. 30-in., $2.40; total, $109,861.

Caney, Kas.—The contract for constructing 21,780-sq. yds. of brick paving was awarded, Sept. 1, to J. W. Kelso, of Iola, Kas., as follows: 11,100-cu. yds. earth excav., 33 cts.; 21,780-sq. yds. cinder base, 10 cts.; 21,780-sq. yds. 2-in. course brick, 45 cts.; 21,780-sq. yds. sand cushion, 10 cts.; 21,780-sq. yds. top course brick, 60 cts.; 2,400-ft. header boards, 6 cts.; 21,780-sq. yds., sand fill, 5 cts.; 3,350-lin. ft. concrete curb, 38 cts.; total, $33,394. Totals of other bids: Grant, Sumner & Conary, Caney, $35,119, and Rushmore & Co., Neodesha, Kan., $35,788.

Muncie, Ind.—Contracts for constructing roads were awarded, Sept. 9, as follows: Jackson st., to Daniels & Lyst, of Anderson, $27,640; Louis Peck, of Muncie, Jefferson road in Terry twp., $8,996, and Gates road, $9,950; Frank Hines, of Muncie, Wilson road, in Center twp., $5,500; Harry McClellan, of Muncie, Hinton road in Washington twp., $4,765, and Crampton road in Harrison twp., $2,039, and Patterson Bros. for Kirkland road, Washington twp., $7,375.

Hartford, Conn.—Contracts for constructing state road work were awarded, Sept. 8, as follows: Town of Suffield, 1,315-lin. ft. macadam, Olmstead & Olmstead, East Hartford, $1.21 a lin. ft.; North Canaan, 3,680-ft. combined macadam with telford base, to Selectment of Town, $1.15 for macadam and $1.50 for telford; Trumbull, 2,700-lin. ft. macadam-telford, T. H. Gill & Co., of Winter Hill Station, Boston, Mass., $1.49 for macadam and $1.90 for telford; Winchester, 4,461-ft. macadam road with combined gutters and retaining wall, Lane Construction Co., of Meriden, $1.66 for macadam, 60 cts. sq. yd. for cobblestone gutters and $6 a cu. yd. for wall; Granby, 5,700-lin. ft., A. Bridge's Sons, Hazardville, $1.44 for macadam and $1.89 for telford road; Granby, 4,700-lin. ft. grading with 5-in. hardening top, with railing and culvert, F. Arrigoni & Bro., Durham, $5,000 for road work and $600 for culvert; Killingiu, 3,235-lin. ft. gravel main highway, awarded to the Town, $1.05 a lin. ft.; Danbury, 935.5-lin. ft. macadam-telford, O. T. Benedict, of Pittsfield, Mass., $1.78 a lin. ft. for macadam and $2.22 for telford; Willington, 800-ft. rubble drain and telford road, T. H. Gill Co., of Boston, $1.50 a lin. ft.; Lisbon (Jewett P. O.), 800-lin. ft. gravel road, T. H. Gill Co., of Boston, $1.28 a lin. ft.; Guilford, 2,000-lin. ft. gravel-telford, F. Arrigoni & Bro., Durham, Conn., $1.20 a lin. ft.

Parkersburg, W. Va.—The contract for paving East st. was awarded to C. Skidmore for $5,084.

Hillyard, Wash.—The contract for constructing sidewalks in Regal st. was awarded to W. J. Smith for $4,711.

Canton, Ill.—The contract for paving with brick was awarded to M. Heckard & Son at $1.12 a sq. yd.

Wichita, Kans.—The contract for paving E. Douglas st. with brick was awarded to H. L. Miles, at $1.97 a sq. yd.

Vicksburg, Miss.—The contract for constructing 2 mis. of graveling on Jackson road was awarded to George King for $10,285.

Chattanooga, Tenn.—The contracts for paving Bailey ave. and Oak and O'Neal sts. were awarded to the Noll Construction Co. for $28,267.61.

Indianapolis, Ind.—The contract for constructing the Fall Creek boulevard extension was awarded to the Moore-Mansfield Construction Co. at 39 cts. a yd.

Geneseo, Ill.—The contract for constructing 14,548 sq. yds. of brick paving was awarded to the McCarthy Improvement Co., of Davenport, Ia., for $29,425.

Niagara Falls, Ont.—The contract for constructing section 4 of the Niagara boulevard was awarded to Upper & Lobb, of St. Catharines, Ont., for $32,500.

Baltimore, Md.—W. M. Elder, 220 St. Paul st., secured paving contracts as follows: 31st st., asphalt, $31,675; Gorsuch ave., bitulithic on bituminous base, $76,777.

Memphis, Tenn.—Paving contracts have been awarded as follows: Asphalt, Madison ave., 3 mis., H. P. Streicher, of Toledo, O., $139,360; Patton st., H. W. Brennan, $2,154; Tate ave., Memphis Asphalt and Paving Co., $3,815.

Hartford, Conn.—Contracts for constructing state road work have been awarded to the Lane Construction Co., of Meriden; Amos Bridge's Sons; Donohue Bros., of Middletown; Connecticut Con-

tracting Co., 84 Temple st., Fairfield, Conn.; Joseph Mascotti, Torrington.

SEWERS.

Santa Monica, Cal.—The sewer committee of the city council has recommended that the electrolytic plant installed by the California Water Purification & Sanitation Co., of Los Angeles, be accepted.

Mobile, Ala.—The Christopher Sewer Co., of Philadelphia, Pa., has been incorporated under the laws of Alabama, and Loveman, Joseph & Loeb, of Birmingham, are designated agents of the company.

CONTEMPLATED WORK.

Oconomowoc, Wis.—A sewerage system is contemplated.

Binghamton, N. Y.—Bids will be asked for constructing a sewer in Lewis st.

Spencer, La.—A sewer in Main st. is proposed.

McGregor, Ia.—Plans for a sewerage system are being prepared.

Williston, N. D.—Plans for a sewerage system will be prepared.

Grand Forks, N. D.—A new sewer in De Mers ave. is contemplated.

Franklin, Ky.—Will vote on the question of constructing a sewerage system.

Millville, N. J.—Plans for the proposed new sewage disposal plant have been approved.

Wausau, Wis.—The construction of 1,020-ft. of sewer in 5th st. is contemplated.

Columbus, Neb.—Will vote on the issue of bonds for constructing a storm sewer system.

Knoxville, Tenn.—Bids will be asked for constructing the second sewer lateral.

Monrovia, Cal.—Locations and surveys are being made for the proposed sewerage system.

Marcus Hook, Pa.—Plans have been prepared for constructing a sewerage system and disposal plant.

Oneida, N. Y.—The construction of about 400-ft. of sewer in Central ave. is contemplated.

Blaine, Wash.—This city contemplates the construction of sewers at a cost of about $40,000.

Medford, Ore.—The construction of a large sewer is contemplated and bids will be asked for soon.

Elgin, Ill.—The city engineer has been directed to prepare plans for a sewer in River st.

Montgomery, Ala.—The extension of the sewerage system is contemplated. W. M. Teague, mayor.

Oswego, N. Y.—Plans are being prepared for constructing a sewer in Mitchell st. Chas. H. Snyder, cy. engr.

Hampton, Ia.—Plans for a drainage system have been prepared by Wallace Treichler, of Rock Island, Ill.

Jessup, Pa.—An ordinance has been passed providing for the construction of the 1st district sewer.

Carterville, Mo.—Plans are being prepared for 5 district vitrified sewers. H. E. Moody, cy. clk.

Haverford, Pa.—Plans have been approved for constructing a sewage disposal plant at Haverford College.

Moundsville, W. Va.—Plans have been completed for constructing the proposed sewerage system. Mayor Williamson.

Narragansett Pier, R. I.—The proposed sewerage system will cost $15,000 to $30,000. W. Herbert Caswell, town clk.

Alexandria, Ind.—The city engineer will prepare estimates of the cost of constructing a sewer in Sherridan ave.

Joplin, Mo.—Plans have been prepared for constructing a brick storm and sanitary sewer. Hiram Phillips, cy. clk.

North Pelham, N. Y.—Will vote on the issue of bonds for installing a system of sewers and a sewage disposal plant.

Highland Falls, N. Y.—Will vote on the issue of $60,000 bonds for constructing a sewerage system and sewage disposal plant.

Mt. Vernon, N. Y.—Revised plans for a sewage disposal plant will be prepared and bids asked for construction soon.

Springfield, Mo.—Preliminary plans are being prepared for constructing a brick storm sewer. G. W. Hackney, cy. clk.

Albany, N. Y.—Bids will be asked for constructing sewers in N. Champlain, Erie and Garden sts. Bd. contract. & sup.

West Allis, Wis.—An ordinance has been passed providing for the issue of $90,000 bonds for the installation of a sewerage system.

Hagerstown, Md.—A resolution has been passed recommending that preliminary steps be taken towards constructing a sewerage system.

Lebanon, Pa.—Bids will be asked soon for constructing 2,000-ft. of 18-in. sewer in Cumberland and 7th sts., Spring and Pheasant alleys.

Poplar Bluff, Mo.—Plans have been prepared for 14 blocks of vitrified pipe sewers. E. C. Hickey, cy. engr.; W. A. Spence, cy. clk.

Oneida, N. Y.—Plans are being prepared for constructing an 8-in. vitrified pipe sewer, with 6-in. laterals. Chas. M. Ruggles, clk. B. P. W.

Lawton, Ok.—The construction of a sanitary sewer system in the Woods, Beal and Mountain View additions, at a cost of $30,000, is contemplated.

Welland, Ont.—Work will commence this fall on the construction of a trunk sewer to cost about $40,000, and several branch sewers to cost about $19,000.

Dayton, O.—Bids will be asked soon for constructing 24 and 36-in. reinforced concrete tile sewers in sundry streets. F. C. Cellarius, cy. engr.

Sioux Falls, S. D.—The construction of a sewerage system on the West Side, north of 10th st. and west of Prairie ave., is contemplated.

Denton, Tex.—A new election will be held during October on the question of issuing $12,500 bonds to build a sewerage system. Ed F. Bates, mayor.

Grand Rapids, Mich.—Plans and specifications have been submitted for a sewer pumping station at the mouth of the big ditch. L. W. Anderson, cy. engr.

Nashville, Tenn.—W. W. Southgate, cy. engr., estimates the cost of constructing 31-mis. of lateral sewers, necessary to complete the sewer system, at $207,000.

Takoma Park, Md.—The question of constructing reciprocal sewerage facilities between the District of Columbia and this town is being discussed. Mayor Platt.

San Francisco, Cal.—The construction of concrete, brick and iron stone pipe sewers is contemplated at a cost of about $3,000,000. Marden Manson, cy. engr.

Chicago, Ill.—A spillway 300-ft. wide connecting the sanitary district canal and the Desplaines river at Willow Springs is to be constructed at a cost of about $15,000.

Plainfield, N. J.—It has been unanimously decided that Hering & Fuller, of New York City, will be engaged to make preliminary surveys for the proposed trunk line sewer.

El Centro, Cal.—The city trustees have adopted an ordinance of intention to ask for an election to vote on the issue of $40,000 bonds for the construction of a septic tank system.

Ft. Dodge, Ia.—Plans have been prepared for constructing a sewerage system to include 2,700-ft. of vitrified tile pipe, 6 manholes, 1 flushtank and 4 lampholes in Central ave. C. H. Reynolds, cy. engr.

Springfield, O.—The city engineer has submitted plans, profiles and specifications for the construction of a combined sanitary and storm sewer in Warder st., with connecting sewers in certain streets.

Baltimore, Md.—B. T. Fendall, cy. engr., has recommended the construction of a sewer in 2nd ave., between Chestnut ave. and Jones Falls, with lateral sewers in Elm, Roland and Hickory aves. and Falls road. Estimated cost $150,000.

Arlington, Tex.—Mayor Weeks has appointed Dr. Spurgeon, Joe Fuller and Rufus Putnam a committee to visit several cities for the purpose of investigating sewerage systems. After the committee's report has been submitted the question of issuing bonds will be voted on.

Watertown, N. Y.—Bids will be asked for about Oct. 1 for constructing a sewerage system for the south and western sections of this city, requiring about 1-mi. of storm and sanitary sewer. Alternate bids will be received for reinforced concrete and brick and concrete construction.

Baltimore, Md.—The sewerage committee approved specifications, Sept. 9, for building the sprinkler, sludge tanks and settling basins in connection with the disposal plant at Back River. Reinforced concrete will be used in the construction, and it will cost $700,000. It will require 4 sprinklers, 4 sludge tanks and 2 settling basins.

CONTRACTS TO BE LET.

Cherokee, Ia.—Bids are asked until Oct. 6 for constructing a sewer. W. Shardlaw, cy clk.

Newport, Ark.—Bids are asked until Nov. 1 for constructing a sewerage system. Lund & Hill, engrs., Little Rock.

Logan, O.—Bids are asked until Oct. 13 for building sewers in North st. and Zanesville road. F. C. Grove, vil. clk.

Dayton, O.—Bids are asked until Oct. 2 for constructing a storm water sewer in indlay st. W. A. Burron, clk. B. P. S.

Corlett, O.—Bids are asked until Oct. 6 for constructing sewers in Rice ave. and Harland and Harvey sts. W. H. Jantzen, vil. clk.

Oakley (Cincinnati P. O.), O.—Sealed bids are asked until Oct. 6 for constructing sewers in sundry streets. Oscar Kosche, vil. clk.

Wilkes-Barre, Pa.—Bids are asked until Oct. 26 for constructing 1-mi. of circular brick sewer. B. K. Finch, cy. engr.; Fred H. Gates, cy. clk.

Guayaquil, Ecuador—Bids are asked until Dec. 1 for constructing a sewerage system. Int. Bureau of Am. Rep., Washington, D. C.

Carthage, O.—Bids are asked until Oct. 10 for constructing sewers in Hamilton Co. Fair Grounds. H. Lee Early, prest. bd. agriculture.

Carthage, O.—Bids are asked until Oct. 10 for construction 1,035-ft. 15-in. and 845-ft. of 12-in. sewer pipe drains, 4 manholes, 5 inlets, etc.

Rockwell City, Ia.—Sealed bids are asked until Oct. 5 for constructing drain No. 75, requiring different sizes of tile. B. E. Stonebraker, co. audt.

Lawrence, Kas.—Bids are asked until Oct. 5 for constructing 6,000-ft. of 12-in. and 1,500-ft. of 15-in. vitrified pipe sewers. F. D. Brooks, cy. clk.

Hope, Ark.—Sealed bids are asked until Oct. 6 for installing a system of sanitary sewers. E. S. Creening, Jr., sec'y bd. sewer comrs. dist. No. 1.

Oregon, Wis.—Sealed bids are asked until Oct. 8 for constructing a main ditch, laterals and tile work. Geo. Hartlein, sec'y bd. comrs. Badfish drainage dist.

Moberly, Mo.—Bids are asked until Oct. 15 for constructing a sewer system dist. No. 28, Morley and Ault sts. and Miller Park Addition. S. T. McDonald, cy. engr.

Baltimore, Md.—Bids are asked until Oct. 14 for constructing sewage disposal works, contr. No. 30; west low level intercepter, contr. No. 31; force main sewer, contr. No. 32; force main No. 33. Calvin W. Hendrick, ch. engr. sewerage comn.

Hamilton, O.—Bids are asked until Oct. 3 for constructing sanitary sewers in a number of streets. B. P. S.

Rye, N. Y.—Bids are asked until Oct. 28 for constructing certain sewers and a sewage disposal plant. Vil. trustees.

Appleton, Wis.—Bids are asked until Oct. 6 for constructing 1,000 ft. of 24 to 30-in. pipe sewer. E. L. Williams, cy. clk.

Louisville, Ky.—Bids are asked until Oct. 9 for constructing 550 ft. of 36-in. and 1,330 ft. of 24-in. concrete sewer. Comrs. of sewerage.

Jefferson, O.—Bids are asked until Oct. 12 for constructing 2,400 ft. of sewer for county buildings and a sewage disposal plant. P. C. Renick, co. audt.

Chicago, Ill.—Bids are asked until Oct. 15 for constructing a concrete conduit, including bulkhead and inverted siphon and a brick sewer in Western ave. Chas. A. V. Standish, secy. bd. local impvts.

CONTRACTS AWARDED.

Hammond, Ind.—The contract for constructing a sewer in Kedzie ave. was awarded to T. L. Ryan & Co., for $303,037.50.

Escondido, Cal.—The contract for constructing a sewerage system was awarded to R. S. Sandell, for $16,843.70.

Sedalia, Mo.—The contract for constructing vitrified pipe sewer No. 41 was awarded to Dean Bros., for $15,000.

Cresco, Ia.—The contract for building sewer No. 8 was awarded to Oliver Kringle, of Elkader, Ia., at $1 per ft.

Ridgway, Pa.—The contract for building a sewerage system was awarded to M. Applegate & Son, of Alliance, O., for $5,000.

Mayville, Wis.—The contract for constructing 6,590-ft. of sanitary sewer was awarded to James McCabe, of Fond du Lac.

Great Falls, Mont.—The contract for constructing a sewer in fourth alley was awarded to Gus Nilson, for $1,098.09.

Tacoma, Wash.—The contract for constructing a sewer in sewer dist. No. 177 was awarded to F. Maruca, for $4,502.29.

Vinton, Ia.—The contract for constructing a sewer was awarded to the People's Construction Co., of Davenport, Ia., for $7,236.

Ashtabula, O.—The contract for building a sewer in Prospect st. was awarded to E. F. Maybach, of Collinwood, O., for $3,999.50.

Hackensack, N. J.—James J. Fusco, of Newark, was awarded the contract, Sept. 8, for constructing a sewer in Poplar ave., for $9,390.

Portland, Me.—The contract for building sec. 1 of the Bradley st. intercepting sewer was awarded to Forgiano & Romano, for $1,269.15.

Milwaukee, Wis.—The contract for constructing sewers in Keefe ave. and Hopkins st. was awarded to Herman Hohensee, for $12,000.

Eveleth, Minn.—The lowest bid submit-

ted for constructing a sewer in Fayal st. was that of C. C. Butler, of Virginia, Minn., at $2,689.

Somerville, N. J.—The contract for constructing a storm sewer in East Somerville was awarded to John McNabb, of Bound Brook, for $5,126.

Cedar Rapids, Ia.—W. A. Edgar was awarded the contract for constructing sanitary sewers, Sept. 9, for $1,703, and storm sewers for $3,446.

Elgin, Ill.—The contract for constructing a sewer system in the 6th ward was awarded, Sept. 16, to Logan & Giertz, of this city, for $83,410.

Lincoln, Neb.—The contract for constructing a storm sewer in N. 27th st. was awarded, Sept. 15, to M. Ford, of Cedar Rapids, Ia., for $2,099.

Bonner Springs, Kas.—The contract for constructing a sanitary sewer system was awarded to Michael Walsh, of Kansas City, Mo., for $16,000.

Gothenberg, Neb.—The contract for constructing a sewerage system was awarded, Sept. 10, to Smith & Sons, of Indianola, Ia., for $4,719.

Kendallville, Ind.—The Moellering Construction Co., of Ft. Wayne, was awarded the contract, Sept. 7, for constructing a sewer, for $12,987.

Dayton, Ky.—The contract for constructing trunk sewers in sundry streets was awarded to the Douglass Plumbing & Heating Co., for $35,427.

Sioux City, Ia.—Sewer contracts have been awarded as follows: brick sewer in W. 14th st., $7,134; Morningside sewer, Lytle Construction Co., $19,000.

Columbus, Wis.—The contract for constructing a sewerage system and septic tank was awarded to the Advance Construction Co., of Waukesha, for $13,000.

Louisville, Ky.—The contract for constructing section D of the southern outfall sewer system was awarded to Weber & Co., of Chicago, Ill., for $186,000.

Vicksburg, Miss.—The contract for constructing a sewerage system 32-mis. in length was awarded to Dunn & Lallande, of Birmingham, Ala., for $148,200.80.

Peoria, Ill.—The contract for constructing the west section of the North Peoria sewer was awarded, Sept. 16, to J. H. Green's Sons' Co., of Chicago, for $219,725.75.

Knoxville, Tenn.—The contract for building a lateral sewer between Overton st. and Leonard Place, connecting with First Creek sewer extension was awarded, Sept. 10, to Engert & House.

Torrington, Conn.—The contract for constructing an outfall sewer from Church st. along the river was awarded to the Pierson Construction Co., of Bristol, for $45,060.

Nashville, Tenn.—The contract for constructing a brick sewer in Edgefield, and a pipe sewer at 4th ave. and Oak st., South Nashville, was awarded to John Broderick & Son, for $1,431.31.

Dayton, O.—Sewer contracts have been awarded as follows: Germantown st. storm water sewer, T. J. Backus Construction Co., $7,992.65; Bolender ave., William Hoult, $19,894.10; Linwood st., Shafer & Dill, $3,027.75.

Washington, D. C.—The contract for constructing sec. C of the East Side intercepting sewer was awarded to E. G. Gummel, of this city, as follows: 8,500 cu. yds. ordinary excav., 79 cts.; 12 cu. yds. sewer brick masry., $14; 130 cu. yds. invert brick masry., $18; 950 cu. yds. concrete masry., $7.75, and 1,280-lin. ft. 6-in. sub-drain, 20 cts.; total, $16,841.

Holdredge, Neb.—The contract for building a sewer was awarded to Lang & Browitt, of University Place, for $18,785.

Redondo, Cal.—The contract for constructing an outfall sewer was awarded to the California Ornamental Brick Co. for $8,064.

Dallas, Ore.—The contract for constructing 19,000 ft. of pipe sewer was awarded to Venske & Taylor, of Cottage Grove, for $17,984.

Pauls Valley, Okla.—The contract for constructing a sanitary sewer system was awarded to the Ardmore Construction Co., of Ardmore, for $15,930.

Cleveland, O.—The contract for building an intercepting sewer between E. 40th st. and Marquette ave., N. E., was awarded to Thomas W. Nicholson for $124,320.

New Orleans, La.—Contracts for furnishing materials for the sewerage and water board have been awarded as follows: Brick, the Mutual Brick and Supply Co., $9,540; cement, the Carolina Portland Cement Co., $3,082; sand, Fritz Jahncke, $1,419; pipe, large pipe, Allen Tupper, $17,054; small pipe, same, $28,942; paving gravel, Foster Creek Concrete Gravel Co.; lumber, G. H. A. Thomas, $11,394.

Evansville, Ind.—Contracts for constructing sewers have been awarded to John L. Newman, as follows: Between Franklin and Michigan, from Baker to Garfield sts.; between Virginia and Iowa, from Governor to Lafayette sts.; between Columbia and Maryland, from Heidelbach to Lafayette sts.; between Wabash and 19th, from Iowa to Delaware sts.; between Delaware and Columbia, from Governor to Lafayette sts., at $1.25 and $1.50.

WATER WORKS.

Crystal City, Tex.—The Crystal City Water Works Co. has been incorporated by J. M. McGinnis, Carl F. Groos and E. J. Buckingham.

Davis, Cal.—The Davis Water Co. has been incorporated to install an irrigating system, drawing its supply from the canal of the Yolo County Water Co. J. A. Harley, J. F. Chiles, W. D. Chiles, G. J. Haussler, R. W. Weise and G. K. Swingle are interested.

Chattanooga, Tenn.—J. E. Ludlow, who was engaged by this city to estimate the value of the plant of the City Water Company, places it at $959,396.13. Those figures do not include estimate of installation or valuation for good will, nor for the real estate owned by the company, which is not essential to the operation of the plant.

CONTEMPLATED WORK.

St. Henry, O.—Voted to construct a water works system.

Mobridge, S. D.—Voted to construct a water works system.

Daytona, Fla.—Voted to issue bonds for constructing water works.

Canajoharie, N. Y.—A new water works system is contemplated.

Norway, Mich.—Voted to issue bonds for water works extensions.

Enterprise, Ore.—Voted to issue $20,000 bonds for water works.

Covington, Tenn.—Voted to issue $60,000 for constructing a water works system.

Alleghany, N. Y.—Voted to issue $30,000 for constructing a water works system.

Loda, Ill.—The question of constructing a water works system here is being discussed.

Athens, Ga.—Plans have been prepared for the enlargement of the water works plant.

Wyandotte, Mich.—Estimates are being prepared for constructing a filtration plant.

Dickinson, N. D.—Voted to complete the water works system at a cost of about $12,665.

Scott's Bluff, Neb.—Will vote on the issue of bonds for building a water works system.

Sausalito, Cal.—Voted to issue $100,000 bonds for constructing a water works system.

Anadarko, Okla.—Bonds will be issued for the construction of the Anadarko water power project.

Montgomery, Ala.—The improvement of the water works system is contemplated. W. M. Teague, mayor.

Urbana, O.—Voted to issue $150,000 for constructing water works. J. G. Wallace, Jr., cy. clk.

Sherman, N. Y.—Will vote on the construction of a water works system at a cost of about $20,000.

Stevensville, Mont.—The question of building a water works system is under discussion. Mayor Lewis.

Grand Forks, N. D.—Plans are being prepared for an additional settling basin for the filter plant.

Covington, Ga.—This city voted to issue bonds for constructing a water works and sewerage system.

Barboursville, Ky.—The Barboursville Water Works Co. has plans for constructing a water works system.

Douglas, Wyo.—The question of constructing municipal water works is being considered by the city council.

Columbus, Ind.—Preliminary steps have been taken towards obtaining a better water supply. Mayor Cochrane.

Sherman, Tex.—The improvement of the water and light system is contemplated. Henry Zimmerman, cy. secy.

Council Bluffs, Ia.—Will vote Oct. 27 on the issue of $600,000 bonds for constructing a water works plant.

Hanover, Ill.—Plans for a water works system will be made by C. H. Chase, of Clinton, Ia. J. White, mayor.

Quanah, Tex.—The city council has decided to have plans and specifications for a water works system prepared.

Carterville, Mo.—Preliminary plans and estimates for a water works system are being made. G. N. Cannon, chmn. water com.

Bismarck, N. D.—City Engineer Atkinson recommends the installation of meters under each catchbasin, at a cost of $9 each.

Augusta, Ga.—Council is considering the question of installing an auxiliary steam pump at a cost of about $60,000.

Collingwood, N. J.—The fire and water comn. has been directed to obtain estimates of the cost of a municipal water works system.

Cashmere, Wash.—Plans and specifications for a water works system have been completed, and bids will be asked soon for its construction.

Rockford, Ill.—Plans are being considered by the Rockford Water Power Co. for constructing a concrete dam to replace the present one.

Cheyenne, Wyo.—Resolutions have been adopted to submit to vote in November the question of issuing $500,000 bonds for water works improvements.

Crawfordsville, Ind.—The water works committee has employed Prof. R. L. Sackett, of Purdue University, Lafayette, to examine the water works plant.

St. Paul, Minn.—The board of aldermen has authorized the issue of $50,000 bonds for the general extension and enlargement of the water works system.

Salem, Ill.—The city council has appropriated a sum of money for the sinking of a test well to ascertain if a sufficient supply can be secured to warrant the adoption of a deep well system.

Amsterdam, N. Y.—This city has retained Stephen E. Babcock, 57 Mann Bldg., Utica, to investigate and prepare plans for repairing, remodeling and increasing the efficiency of the water system and conduit lines.

Bluffton, Ind.—The directors of the Elm Grove Cemetery have decided to install a complete private water works system, comprising a pumping plant and 1,000 ft. of pipe, to carry water to all parts of the grounds.

Great Falls, Mont.—Special.—The Cottonwood Coal Co. contemplates laying a water main from Wolf creek to Windham, a new coal town on the Billings & Northern Railway, a distance of 20 mis. This city contemplates the purchase of a new pump with a capacity of 2,500,000 gallons.

Baltimore, Md.—Water Engineer Quick has devised a plan for increasing the water supply 2,000,000 or 3,000,000 gallons without building additional reservoirs. He contemplates lowering the 30-in. suction main in Druid Hill Park and the 48-in. main on a hill a short distance east of Greenmount Cemetery. The present height of these mains deprives the city of millions of gallons of water because the pumping stations cannot send it through the pipes after the water falls to a certain depth in the reservoirs. It is estimated that $705,735 will be needed next year for expenses and general improvements.

CONTRACTS TO BE LET.

Red Oak, Ia.—Bids are asked until Oct. 6 for installing a 45-h.p. pumping plant. Cy. clk.

Portland, Ore.—Bids are asked until Oct. 8 for supplying this city with a water tower.

Victoria, B. C.—Bids are asked until Oct. 26 for supplying 3,500 meters for the Victoria water works.

Shakopee, Minn.—Bids are asked until Oct. 5 for water works extensions. C. Theo. Weiland, cy. recdr.

Haddonfield, N. J.—Bids are asked until Oct. 6 for constructing a water works system. J. Morris Roberts, mayor.

Houston, Tex.—Bids are asked until Oct. 19 for installing a pumping engine at the water plant. H. B. Rice, mayor.

Burlington, Col.—Bids are asked until Oct. 12 for constructing a water works system. W. W. D. Selder, chmn. w. w. com.

Harrisonburg, La.—Bids are asked until Oct. 5 for drilling a 4-in. artesian well. H. W. Bethard, secy. Police Jury.

Grand Forks, N. D.—Bids are asked until Oct. 5 for constructing a water main in De Mers, Geiger and Jennie aves. W. H. Alexander, cy. audt.

Burlington, Ia.—Bids are asked until Oct. 6 for constructing a pumping plant for a drainage system. Co. audt.

Verona, N. J.—Bids are asked until Oct. 28 for constructing a water works system. Wm. A. Smith, chmn. com. on water sup.

Kiowa, Kans.—Bids are asked until 5 p. m., Oct. 2, for installing water works and electric light system. C. H. McBrayer, cy. clk.

Hope, Ark.—Bids are asked until Oct. 6 for constructing a water works system. E. S. Greenberg, Jr., secy. bd. w. w. impvt. dist. No. 1.

Evansville, Ind.—Sealed bids are asked until Oct. 12 (readvertisement) for con-

structing a mechanical filtration plant. W. M. Madden, clk. w. w. dept.

Oteo, Okla.—Bids are asked until Oct. 7 for constructing a tank and tower, water mains, etc., at Oteo Indian School. F. E. Leupp, comr. Indian Affairs, Washington, D. C.

Cohoes, N. Y.—Bids are asked until Nov. 2 for plans and specifications, with approximate estimate of the cost of a mechanical filter plant. H. L. Shaver, prest. bd. water comrs.

Chagrin Falls, O.—Bids are asked until Oct. 14 for constructing a 4-in. water main and appurtenances in Fenkell ave., Franklin and Orchard sts. and Solon road. R. W. Stoneman, clk, trustees pub. affairs.

Milwaukee, Wis.—Sealed bids are asked until Oct. 2 for furnishing a pumping engine at the North Point pumping station on the shore of Lake Michigan. Chas. J. Poetsch, chmn. B. P. W.

Des Moines, Ia.—Sealed bids are asked until Oct. 6 for furnishing and erecting a pumping plant, comprising 1 water tube boiler, 1 engine, 2 centrifugal pumps, with foundations, buildings, appurtenances, piping, etc. Joint bd. supvrs. Louisa and Des Moines counties.

Passaic, N. J.—Bids are asked until Oct. 30 for the following: Distributing, laying 37 mis. 6 to 20-in. pipes, hydrants, gate valves, specials, etc.: furnishing new water supply, to be taken from wells or surface streams. George K. Rose, chmn. council com. on water supply.

Jackson, Miss.—Bids are asked until Oct. 6 for furnishing hydrants, valves and valve boxes for 20 mis. of new water mains; furnishing manhole castings for 9 mis. of sewers, and for laying c. i. water mains and vitrified clay sewer pipe. Hamilton Johnson, cy. engr.

CONTRACTS AWARDED.

Rockville, Ind.—T. A. Hardman, of Olney, Ill., was awarded the contract for constructing a water works system for $12,450.

Bellevue, Ky.—The contract for supplying water to this city for 20 yrs. was awarded to Ernst & Ellerhurst, Sept. 10.

Hospers, Ia.—The Des Moines Bridge & Iron Co., of Des Moines, was awarded the contract for constructing a water works system for $7,150.

Fort Dodge, Ia.—The contract for a new pump for the pumping station was awarded to the Canton-Hughes Co., of Canton, O., for $7,979.

Owosso, Mich.—The contract for installing two Scotch marine boilers for the water works was awarded to Young & Summers, of Toledo, O., for $6,500.

Wolfeboro, N. H.—The contract for furnishing water pipe for the "wild line" of the new water works system was awarded to R. D. Woods & Co., of Philadelphia.

Hopewell, N. J.—The contract for extensions to the water works system and sinking wells was awarded to the McGovern Contracting Co., of Trenton, N. J., for $10,350.

Bonner Springs, Kans.—The contract for constructing a water works system was awarded, Sept. 4, to J. J. Donnegan Construction Co., of Shenandoah, Ia., for $21,000.

Worthington, O.—A 25-yr. franchise has been granted to Bond S. Neff and W. H. Matticks, of Columbus, who will immediately form a stock company and install a water works plant.

Clarksdale, Miss.—Contracts for constructing a water works system have been awarded as follows: Concrete steel chimney, Weber Co., of Memphis, Tenn.; engine, Ball Engine Co., Erie, Pa.; generator, Crocker-Wheeler Co., Ampere, N. J.

Winnfield, La.—The contracts for water works equipment have been awarded as follows: Boilers, engines, pumps and air compressor, Wm. Luck & Co., of New Orleans; lead and pipe, Ahrens & Ott Mfg. Co.; water pipe, Dimmick Pipe Co., of Birmingham.

Garfield, N. J.—Contracts for extending the water distribution system and for erecting a steel standpipe were awarded, Sept. 4, as follows: Extension of water pipes, George Sargent, Jr., $11,300; steel standpipe, Tippett & Wood, Phillipsburg, N. J., $5,469; pump and boiler house and reinforced concrete pump pit and reservoir, Sargent & Warren, $7,000.

Stickney, S. D.—Contracts for constructing water works have been awarded as follows: 6-in. well, A. V. Depue, of Plankinton, S. D., $1.75 a ft.; remainder of system, Stillwell & Kedal, as follows: 6-in. c. i. water main, 70 cts.; 4-in. c. i. main, 55 cts.; specials, 3½ cts. per lb.; hydrants, 90-ft. steel tower, 40,000-gallon cypress tank, pumping station, machinery, valves, hydrants, etc. Bids were opened on Aug. 22. Dakota Engineering Co., of Mitchell, S. D., are engrs.

Boston, Mass.—The contract for constructing c. i. pipe line in Boston and Brookline was awarded, Sept. 2, to Bruno & Petitti, of Boston, as follows: Laying 12,400 lin. ft. 48-in. c. i. pipe, $2.60; 100 lin. ft. 36-in., $2; 100 lin. ft. 12-in., for blow-offs, $1; 600 cu. yds. rock excav. above grade, $3.25; 10 cu. yds. rock excav. below grade, $4; 20 cu. yds. earth excav. below grade, $1.50; setting 7 air valves, $2.50; 5 chambers for 36-in. valves, $50; 18 chambers for blow-offs, by-passes and air valves, $35, and 100 cu. yds. concrete masonry, $7; total, $36,157.

Springfield, Mass.—The contract for constructing 12 mis. of pipe under contract for Little River Water Supply Co., No. 4, was awarded, Sept. 9, to T. A. Gillespie Co., 90 West st., New York City, as follows: 16,000 ft. 42-in. steel pipe, ¼-in. laid, $6 per ft.; 34,000 ft. 42-in. steel pipe, 5-16 in. laid, $6.60; 7,900 ft. 42-in. steel pipe, ⅜ in. laid, $7.25; 3,400 ft. 42 in. steel pipe, 7-16 in. laid, $8; 3,000 cu. yds. rock excav., $2.75; 1,300 cu. yd. concrete, $6; Westfield river crossing (lump sum), $5,000; other crossings (lump sum), $1,500; old rails (lump sum), $600; total, $428,025.

Livermore Falls, Me.—The contract for laying c. i. pipe and constructing a reservoir was awarded, Sept. 1, to R. D. Shanahan, 102 Exchange st., Portland, as follows: Reservoir—800 cu. yds. earth excav., 33 cts.; 3,500 cu. yds. rock excav., $1.73. Pipe Laying—50 lin. ft. 16-in. pipe, 70 cts.; 2,200 lin. ft. 12-in., 65 cts.; 100 lin. ft. 10-in., 57 cts.; 50 lin ft. 8-in., 45 cts.; 1,400 lin. ft. 6-in., 35 cts.; 60 lin. ft. 4-in., 29 cts.; 900 lin. ft., removing 4-in. and 6-in., 5 cts.; setting five hydrants, ea. $16; inserting 6 gates, ea. $10; 460 cu. yds. rubble masonry, $3.50; 220 cu. yds. rubble masonry, $4.37; 100 cu. yds. concrete, $8; 100 cu. yds. rubble masonry, $3.79; 250 cu. yds. dry rubble wall, $1.25; pumping station, $800. Total, excluding pumping station, $11,819. Grand total, $12,619.

Stamford, Conn.—Bids for constructing a dam and doing other work necessary for the enlargement of the reservoir of the Stamford Water Co. were submitted, Sept. 10, as follows: A. B. Griswold, New Britain, $103,045; Godwin Constr. Co., 30 Church st., New York, N. Y., $108,765; E. G. Bangs, New York, N. Y., $114,532; R. K. Everitt & Co., Tarrytown, N. Y.,

$115,504; Boston & N. Y. Cont. Co., 220 Devonshire st., Boston, Mass., $117,745; N. Y. C. & J. F. Co., 15 Broad st., N. Y., $118,480; Bunting, Bull Co., Lever Bldg., Flushing, N. Y., $122,100; O'Brien Const. Co., Waterbury, $122,320; C. W. Blakeslee & Sons, New Haven, $123,322; R. W. Sherman, Utica, N. Y., $125,770; Arthur McMullen, Stamford, $127,710; John O. Merritt Co., Portchester, N. Y., $129,320; J. B. Malatesta, 3169 Jerome ave., New York, N. Y., $130,925; R. E. Boggs, Charlottesville, Va., $131,617; Richards & Gaston, 143 Liberty st., New York, N. Y., $134,825; Tucker & Vinton, 103 Park ave., New York, N. Y., $139,345; Coleman Bros., 15 Court Sq., Boston, Mass., $143,215; Russell Contr. Co., 156 5th ave., New York, N. Y., $147,098; United Eng. & Con. Co., 32 E. 33d st., New York, N. Y., $149,959; F. Wardwell, Stamford, $153,210; Decicco Contr. Co., Larchmont, N. Y., $167,145.

BRIDGES.

Toledo, O.—Bids are asked until Oct. 5 for constructing abutments for 3 bridges. Co. audt.

Elkhart, Ind.—Bids are asked until Oct. 6 for building a steel bridge in Union twp. Co. audt.

Angola, Ind.—Bids are asked until Oct. 5 for building a cement abutment. Thos. Gillis, co. audt.

Cleveland, O.—Bids are asked until Oct. 3 for constructing bridge work. A. B. Lea, co. surv.

Stockton, Cal.—Bids are asked until Oct. 6 for constructing a bridge at Paradise Cut. Co. supvrs.

Vincennes, Ind.—The county council contemplates the construction of a bridge over White river, near Edwardsport.

Colona, Ill.—A petition is being circulated asking for the erection of a bridge across Rock river here. Bd. supvrs.

Terre Haute, Ind.—Bids are asked until Oct. 3 for building a bridge over Swope ditch. Louis P. Seeberger, chmn. co. comrs.

Two Harbors, Minn.—Bids are asked until Oct. 6 for constructing a steel bridge over Beaver river. John P. Paulson, co. audt.

Ottawa, Ill.—Bids are asked until Oct. 6 for erecting a sub and superstructure for a bridge across Illinois river. Cy. clk.

Manhattan, Kans.—Bids are asked until Oct. 9 for constructing 3 steel bridges in various townships. Geo. H. Hungerford, co. clk.

Joplin, Mo.—J. B. Hogdon, cy. engr., has prepared plans for building a steel viaduct over East Joplin creek. Hiram Phillips, cy. clk.

San Bernardino, Cal.—Plans are being prepared for constructing a steel bridge over City creek, on Highland ave. M. L. Cook, co. surv.

L'Original, Ont.—Bids are asked until Oct. 6 for erecting an iron bridge and for concrete and stone work. Abbott Johnson, co. clk.

Cincinnati, O.—Bids are asked until Oct. 9 for constructing a bridge over Little Duck creek, at Settle st., Madisonville. Co. comrs.

Gaffney, S. C.—Bids are asked until Oct. 5 for erecting a steel or wooden bridge across Buffalo creek. E. F. Lipscomb, co. supvr.

Hutchinson, Kans.—A petition is being circulated asking for the erection of a bridge across the intersection of Avenue A with Cow creek.

Ottawa, Kans.—Bids are asked until Oct. 3 for constructing stone piers for a bridge over Walnut creek, in Peoria twp. W. M. Staley, trustee.

Green Bay, Wis.—The citizens voted, Sept. 1, to issue $150,000 bonds for erecting a bridge across Fox river, at Walnut st. W. H. Reed, cy. engr.

Wilburton, Okla.—Bids are asked until Oct. 6 for erecting a steel bridge with stone abutments over Gaines creek. H. E. Johnson, chmn. co. comrs.

Greencastle, Ind.—Bids are asked until Oct. 3 for constructing the sub and superstructure and approaches to a bridge. Geo. Raines, chmn. co. comrs.

Augusta, Ga.—Specifications have been submitted and bids will be asked for building a new steel bridge across the river at Center st. Comr. Wingfield.

Little Rock, Ark.—A contract has been awarded to the Arkansas Corrugated Metal Culvert Co. for furnishing 1,200 ft. of culvert to the city of Helena.

Morristown, Ind.—Plans will be prepared and bids asked for erecting a bridge on the line between Rush and Shelby counties. T. L. Sleeth, twp. trustee.

Greenville, O.—Bids are asked until Oct. 3 for constructing the substructure of a bridge over Stillwater creek, in Richland twp. Jas. R. Marker, co. surv.

Portland, Ore.—City council passed an ordinance, Sept. 9, authorizing the sale of $450,000 bonds for constructing a bridge at Madison st., across the Willamette river.

Austin, Tex.—Bids are asked until Oct. 5 for plans and specifications for a reinforced concrete bridge across Colorado river, at Congress ave. John W. Hornsby, co. judge.

Ontario, Ore.—Bids are asked until Oct. 5 for constructing a combination steel and wooden bridge across Snake river, 1 mi. east of here. J. A. Lackey, chmn. Ontario bridge comn.

Great Falls, Mont.—Special.—Contracts for building bridges across Hound creek, Smith river and Sun river were awarded to the Midland Bridge Co., of Kansas City, Mo., for $20,195.

Urbana, Ill.—Bids are asked until Oct. 3 for constructing a steel superstructure for a highway bridge. Plans and specifications are on file with Ira O. Baker, Champaign, Ill.

Chickasha, Okla.—Bids are asked until Oct. 5 for constructing 20 bridges, involving 1,327 ft. of bridging and substructure for same, and 718 ft. of pile approach. E. E. Colby, supt. constr.

Cincinnati, O.—Bids are asked until Oct. 12 for erecting the superstructure of a viaduct for the terminal track from 8th st. to McLean ave., to 3rd and Front sts. Bd. trustees Cincinnati Southern Ry., Ingalls Bldg.

Springfield, Mo.—The construction of 2 steel bridges in Taylor twp. is contemplated. W. B. Cloud, co. clk. Plans are being prepared for 2 reinforced concrete bridges at Boonville and Main sts. G. W. Hackney, cy. clk.

Pawhuska, Okla.—Bids are asked until Oct. 3 for constructing 7 highway bridges. Bids will be received on steel and wood, stone arch masonry and reinforced concrete, stone masonry piers and abutment walls for steel bridges. W. M. Sloan, co. clk.

Richmond, Ind.—This county has appropriated $5,000 and will let contracts soon for building 10 bridges during 1908. An appropriation of $25,000 has been made and contracts will be let later for building 10 bridges during 1909, three of which will cost from $4,000 to $4,700.

STREET LIGHTING.

Danbury, Ia.—Estimates are being prepared for a village lighting plant.

New Concord, O.—Council is considering the question of constructing an electric light plant.

Hamilton, O.—The feasibility of reconstructing the municipal gas plant is being considered.

Goshen, Ind.—City council is considering the question of rebuilding the city's commercial lighting plant.

Ponce, P. R.—Bids are asked until Oct. 15 for constructing an electric light plant. Blas C. Silva, cy. engr.

Atlantic, Ia.—Bids are asked until Oct. 8 for erecting a steel tank gas holder. F. A. Kidder, Red Oak Gas Co., Red Oak, Ia.

Victoria, B. C.—Bids are asked until Oct. 5 for supplying and installing electric equipment. W. W. Northcott, cy. purchasing agt.

Oneonta, N. Y.—Bids are asked until Oct. 20 for lighting the streets, requiring 100 arc lights, 2½ or 5 yrs. Henry D. McLawry, vil. clk.

Lima, O.—Plans and specifications for constructing a municipal electric light plant will be prepared by J. Walter Esterline, of Lafayette, Ind.

Bristol, Tenn.—A contract has been awarded the Bristol Gas and Electric Co. for new generators, turbine engines and other machinery, for $50,000.

Boston, Mass.—Bids are asked until Oct. 8 for furnishing and delivering electrical junction boxes and cable. Lieut. Col. Edward Burr, corps engrs.

Pender, Neb.—The construction of an electric light plant is contemplated, and bids for the bonds will be received about Oct. 1. R. P. Mason, vil. clk.

Baltimore, Md.—Estimates are being prepared of the probable cost of a public lighting plant to be built in connection with the power house for the pipe-line system.

Kiowa, Kans.—Bids are asked until Oct. 2 for constructing an electric light plant, with generator, switchboard, motor transformers, arc lamp, etc. Burns & McDonnel, engrs., Kansas City, Mo.; J. N. Jerr, mayor.

Corpus Christi, Tex.—The People's Light Co., recently incorporated, will build and operate a plant to supply light and power to the city and vicinity. Gas and electric machinery will be installed. Thos. E. Craig, supt. & genl. mgr.

Anadarko, Okla.—This city is ready to receive bids on $100,000 bonds to dam the Washita river and install water power, extend light, water and sewer services and build a city hall. Successful bidders will be permitted to outline the method of procedure for calling for an election to vote on bonds. J. C. Stelzner, mayor.

Buffalo, N. Y.—Special.—This city has declared its intention to construct and install an engine and generator at the Hamburg Canal pumping station, for the purpose of furnishing light and electric power, and will ask for bids as soon as plans and specifications have been completed.

GARBAGE DISPOSAL, STREET CLEANING AND SPRINKLING.

Davenport, Ia.—The construction of a garbage crematory is favored by the bd. of health.

Elyria, O.—The construction of a garbage disposal plant between this city and Lorain is proposed. Henry Wagner, engr., of Cincinnati, is interested.

Youngstown, O.—The contract for the collection and disposal of the city garbage for the next year was awarded to C. C. Fisher, of York, Pa., at $2.90 a ton.

Newcastle, Pa.—The contract for the collection and disposal of the city garbage and refuse for 1 yr. has been awarded to the Newcastle Garbage Co., of this city.

PARKS.

Dublin, Ga.—A 10-acre tract of land has been presented to this city for a park.

Florence, Colo.—The Civic Improvement League has acquired a block of land for a park.

St. Joseph, Mo.—Detailed plans are being prepared for the development of Bartlett Park.

La Crosse, Wis.—The park commission is planning to expend $100,000 in park and boulevard improvements.

San Francisco, Cal.—Surveys are being made on the new addition to Golden Gate Park, which will extend the park to the Presidio.

FIRE APPARATUS.

Red Wing, Minn.—The purchase of a new steamer, at a cost of $1,800, is contemplated by the fire board.

Vancouver, B. C.—Bids are asked until Oct. 15 for supplying this city with an automobile chemical and an automobile hose wagon.

Wausau, Wis.—The mayor has recommended the purchase of a steamer, chemical engine, larger water pipe, and additional equipment at both engine houses.

New York City.—Bids are asked until Oct. 5 for furnishing and installing a dry sprinkling fire protection system for the piers and bulkhead platform extensions on the Chelsea section, between W. 13th and W. 22nd sts., North river. Allen N. Spooner, comr. docks.

TOO LATE FOR CLASSIFICATION

Chicago, Ill.—Agitation has been renewed for a municipal garbage disposal plant.

Crofton, Ia.—Sealed bids are asked until Oct. 3 for constructing a water works system. F. A. Barker, vil. clk.

Indianapolis, Ind.—Sealed bids are asked until Oct. 10 for furnishing 1 road grader. John McGregor, chmn. co. comrs.

Washington, D. C.—Sealed bids are asked until Oct. 19 for furnishing a rock-crushing plant. Genl. Purchasing Agt., Isthmian Canal Comn., Washington.

Oakland, Cal.—Sealed bids are asked until Oct. 14 for extending storm culvert from Excelsior ave. to Lake Shore ave. Walter B. Fawcett, secy. B. P. W..

West Chester, Pa.—A special election will be held Dec. 1 to vote on the question of issuing $150,000 for constructing a new sewerage system and sewage disposal plant.

Vol.